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ASIATIC SOCIETY

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NEW SERIES.

"It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science, in different parts of *Asia* will commit their observations to writing, and send them to the Asiatic Society in Calcutta; it wil languish, if such communications shall be long intermitted; and will die away, if they shall entirely cease."—SIR WM. JONES.

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CONTENTS.

PART II.

No. 127.

No. 128.

No. 129.

INDEX TO PART II.

INDEX TO NAMES OF AUTHORS.

PART II.

JOURNAL

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ASIATIC SOCIETY.

A Description of the Coal Field of the Damoodah Valley, and the adjacent Countries of Beerbhoom and Poorooleah, as applicable to the present date 1842. *By* J. Homfray, Esq.

The coal field of the Damoodah valley, and its adjacent river the Adji, commences at about the parallel of latitude 23° 16′, and continues uninterruptedly upwards to nearly the whole length of the Damoodah river, until near to its source, which lies in the hills near Ramghur. Along both of its banks lies the mineral coal field, commencing near to the junction of the Singharun Nullah, which falls into the Damoodah river near to the Serampore Indigo Factory. This point at which, however, none of the mineral is found, is the lowest end of a line stretching (nearly direct) across the country to the Adji river, at a place called Seedpoora Ghaut, where also is the extreme limit of the field at the lowest end on that river. This then forms the boundary on the south side, its northern is stated as above ; the western limits are the igneous and granitic hills *with their subdivisions*, which lie at a distance, generally of four or six miles from the right, or western bank of the Damoodah, and continue their course to the high lands in the Ramghur district, and crossing through a portion of Chota Nagpore which abuts against the Damoodah and the Barracar rivers, the eastern limits. The North-east, are the range of high hills flanking the Damoodah and the Barracar rivers. Descending this last river to near to Dabystan, it crosses that river, next to where the

schistose formation of hills commences, and which run across to Monghyr and the Gurruckpore districts. Bending round with these hills, it crosses over to the Adji river, and thence skirting the foot of the igneous hills, which continue towards Rajmahal, the mineral *decreases* as the distance increases, or as it recedes beyond the Adji river, a small portion, however, alone of this country, east of the Adji, can be called a continuous coal field, and where it descends to a village called Kosta, on the east bank of the Adji, it ceases; and the mineral and its concomitant sand-stone are lost. Eruptions of granite, gness and basalt distinctly mark its limit, until it reaches the very extraordinary mass of gness rocks at the town of Debrazpore, beyond which easterly, there are occasional traces of sand-stones and bituminous shales; and in more than one or two localities immediately beneath the hills, and within the dense forests, traces of very inferior coal are found; and at one locality on the Bermany Nullah, which lies east of Soory or Beerbhoom, about 24 miles, coal is found in quantity, but of a quality so nearly approaching to bituminous shale, as to be unfit for steam purposes. Other localities there are, but the quality of coal remains to be tested; but they are all of them of the same worthless nature as that at Bermany Nullah. I mention this, just to draw attention to a parcel of trashy nonsense, put forth in some publication; something which would induce people to believe, that the Sylhet and Burdwan coal field, (as it is there called) have some, or had some connexion, which by a marvellous occurrence has been disjoined, and that Sylhet and Chirra Poonjee are now journeying towards the moon. There is no more similarity between the coal and its concomitant rocks in the Damoodah and that of the Sylhet and Garrows, than between chalk and cheese. None but the most profoundly ignorant of the matter, would entertain a doubt of it. The whole is a mere literary phantasmagoria, got up *ad captandum*, and put forth in a manner calculated to mislead the unwary. I may be told, that our operations are as yet in their infancy; but I cannot see a trace which long and great experience in such matters would warrant me, or even any unpractised miner, although not educated in the school of modern mineralogists, of snail-hunters and saxo-florists, to arrive at any other conclusion, but that the two great deposits are wholly different. The Damoodah and Adji country is, throughout that portion where

the mineral districts lie, one continued line of country which has been subjected to the greatest convulsions of nature, and the immense chains of hills of igneous origin, which are visible throughout, are corroborative of it. The connexion between these hills at distant points, crossing the coal field, is proved by the line of the great basaltic dykes, which protruding through the sandstone up to the surface of the ground, are traceable from one point to another; whilst we have proofs of the changes, which have been wrought upon the materials by these mighty protrusions. It is not very often that the occurrences of the intersection of basaltic dykes is observed. There are, however, within this field, a vast number of these dykes which cross one another, and of course they must have occurred at different ages, as will be seen hereafter, and doubtless the changes in the subterranean minerals have been affected by it. The most remarkable one which causes these changes in the coal field is, one called the Salmah dyke, and one nearly parallel to it at Bharah. These are distinctly traceable for about 30 miles, and have produced a thorough change in the minerals which are deposited on either side of it. The upheave is evidently to the N. E., but to what exact amount I cannot say; but I conjecture from many circumstances which when examined closely into, leads me to think that the dislocation is of some hundreds of feet. The quality of the coal is also changed, and that portion of the coal field hitherto opened upon, and whose mineral has been largely consumed, lead me to believe, that the coal on the south-western, or *lower* side of this dyke, is much superior to that on the North-eastern. There are other large dykes and faults of magnitude which are already discovered, and from which there are many alterations discernible, independent of lesser faults and interruptions such as impede the progress of the miner. At some distance up the Damoodah river on the South-west bank, is the great hill of Pachete, from which innumerable dykes issue; and all around its base, and between it and the river, a space of about four miles, the country although abounding in coal, is full of these dislocations. It is nearly opposite to the centre of this hill, which is about seven miles in length, that the Barracar river unites with the Damoodah. The Baracar rises in the same range of hills as the Damoodah, and continues its course through the hill for some miles, until it is turned by the mighty Parsonath hill

towards a more easterly direction, and then thrown towards the schistose hills of the Monghyr range, continuing a rocky stream until it bursts through the schistose rocks near to the Panraw hill, and between it and Dabystan, where it enters the coal field, and continues onward until it abuts against the base of the Pachete hill. The Barracar river has on its northern bank innumerable faults, and all running parallel with it, and as I said before, they are traceable from the Pachete hill and *run* towards the Panraw hill. To the North-west of these dykes, which lie generally at a distance of about one to two miles from the Barracar river, no coal is discovered. The eruption of *greenstone dykes*, which I have not only discovered on the surface of the ground, but by sinking pits I have come down upon them at considerable depths, and found them dipping at a sharp angle, completely cutting off all the minerals, and a change in the nature of the rocks which accompany it, takes place. Within the space of country, between the rivers Barracar, Adji and Damoodah, and a line of country generally four to six miles in breadth, to the South and West of this last river, is the coal field; and glancing at a map, it will be seen it is of great extent, and with little exception, may be taken to be full of coal and iron-stone. The veins, however, are not all of them of such thickness, or of such a quality as will warrant any profitable operations for working the mineral. In some situations the best veins lie at great depths, whilst at others, they are comparatively shallow, and are found to a great extent upon the crop of the vein. Much of the coal hitherto worked and brought to Calcutta, is from such openings, and it is well known, that it is necessary to ensure obtaining good coal that the vein be found and worked from beneath some superstratum; and if that be of sand-stone or shale, so much more likely is the mineral to prove of good quality, and less liable to perish with the weather; wasting its tar as well as crumbling and mouldering to dust, and turning grey coloured so soon as the natural tar has been evaporated.

I shall first place an account of the works now opened, and at which coal is obtained and despatched for sale to Calcutta, commencing at the lowest end, where the Benares new road having passed over the alluvial plain near Burdwan, commences a slight ascent nearer to the jungle of Furreedpore. This jungle, which is of some extent, is upon a red konkary soil, and reaching the dawk bungalow of Kyrasole, which

is near to the centre of this jungle; there a reddish sand-stone conglomerate is perceived; thence commences a gradual descent until we reach the Singharun Nullah, before alluded to. This is the first point of the coal field on the south limit. The distance from this point on the Benares road to the junction of the Singharun with the Damoodah is about five miles, and to cross the country northward to the Adji at Seedparah Ghaut is about seven miles, so that the breadth of land between the two rivers of Damoodah and Barracar may be taken on an average of twelve miles. The streams are nearly parallel until the point where the Barracar enters the Damoodah; probably the same causes which were exerted to turn that river to the east have operated to do the same by the Adji, which similarly bends easterly at nearly the same parallel of latitude. Into the Damoodah, or southern river, we trace the following minor streams, proceeding upwards and commencing with the Singharun, which small nullah drains the lands all the way up to Hidgelgurreah hill, situated about three miles from the Adji. In this nullah coal is found to crop out at a distance from the Benares road about one and a half mile, and the basset edge of coal veins are traceable along its bank for about three to four miles. Advantage has been taken of that circumstance to open collieries upon it, and to drain the mine-water into this nullah. There have been workings upon this vein of coal, which varies from seven to nine feet in thickness, ever since 1832, but success has not attended the operations, as the object of despatching the coal by the way of the Adji river down to the river Hooghly has proved both dangerous and expensive, and the coal obtained therefrom, probably owing to its proximity to the surface, has been of inferior quality. Late openings have been made with a view of conveying it to the Damoodah, which is five miles distant, to which it has to be carted at considerable cost; whilst to the Adji, that distance is from the nearest of those openings six miles, and others seven miles. The line in which this vein of coal is found, continues from the first opening alluded to across the country and to the Hidgelgurreah hill, and thence across the river Adji into the Beerbhoom district. Although even near to the Adji, it is not discovered of so great a thickness, the vein having evidently "thinned out" towards the village of Beercoltee. The first opening or lowest down the stream is that by Messrs. Erskine, being the one now whose coal is conveyed by carts to the

Damoodah. A mile and a half higher up, are the openings of Mr. Rogers and Mr. Blake. This last gentleman commenced in 1832, with a view of conveying its produce down the Adji; but hitherto the greatest extent has not exceeded a few thousand maunds, such is the ungovernable nature of that stream and the shallowness of water, and dangerous rocky bottom, that all efforts to overget it prove unavailing. There is but one way of turning the Adji to any account, which is by conveying the coal in carts lower down the river, about 25 to 30 miles, and where the river navigation is less dangerous, although even from that point it is much inferior to its equally ungovernable brother the Damoodah. The vein of coal is but one along this line, and when one reaches to the Hidgelgurreah hill, and between it and the Adji, the iron-stone measures are found cropping out; these I shall hereafter notice. The next nullah above the Singharun, and on the same bank, is the Nooneah. This is the most considerable of all those minor streams at its confluence with the Damoodah, where are situated the collieries of Messrs. Carr, Tagore, and Co.; and Messrs. Gilmore and Homfray, both of which adjoin each other, and are at a distance of only a few hundred yards from the main river. The popular name of Raneegunge, is derived from the proprietary rights of one of them having been vested in the late Ranee of Burdwan, and which also gave rise to the equally fallacious term of Burdwan coal. These collieries have their pits sunk down to the main vein of coal, generally to a depth of ninety feet, the vein varying from seven and a half to eight and half feet in thickness; the covering immediately over the vein is dark shale, and over which is a soft friable sand-stone, and which enables the vein to be excavated in openings of generally four yards in width; the working underground being conducted on the pillar and stall system, and with so excellent a roof over the coal it allows full three-quarters of vein to be excavated, the principal loss or waste of coal being attributable to its nature, being a free burning or non-binding coal. The small, or dust, which is produced in its working being of no value, is left in the hollows of the work. Fortunately, there is no appearance of fire-damp in this vein of coal, and the whole system of working has enabled them hitherto to be kept extremely well ventilated. This vein of coal is perceptible for seven or eight miles up this nullah, and is found cropping out in very

many places in that distance, until it is found where the Benares road crosses this stream, and within two miles of the Assensole dawk bungalow.

Although there are no great impediments to the present works by faults, still they exist around and within these collieries to some extent, and it is evident from the view any scientific person would take of it, that but for such dykes, this noble vein would discover itself in many other places; but no where between these collieries, and those of Singharun is there any visible traces, though beyond a doubt the vein lies beneath the whole extent of ground between these nullahs. Higher up this nullah about one mile, and near to the village of Damooleah, the coal is also worked; it was originally opened and worked by Mr. Jessop and its produce carted to the Damoodah; its proprietary right is now vested in, and exercised by, Messrs. Carr, Tagore and Co. Higher up the nullah, and near to the Benares road, there is another opening by the same proprietors, called Moishla or Damarah, the produce of which is carted about two and a half miles to the Damoodah. Between this locality and the Damoodah near to Cheluad, a pit has been sunk 100 feet, and has passed through two small veins of coal similar to those found on the opposite, or south-western bank of the river at Salmah, where a pit was commenced to be sunk by me in 1831, and after a cessation of two years, has been continued until the present time, June 1842. It has reached a depth of above 210 feet, and has passed through seven different veins of coal, and one of iron-stone. None of these veins, however, are of a description that would warrant mining operations thereon, varying in thickness from 16 inches to three feet only, and are of an inferior quality. I am still sinking, with a view to attain a vein of about seven feet thickness, and of excellent known quality. The strata which have been passed through in this pit, are the usual ones of sand-stone and shale, but differing from any others that I have met with in this country, and approaching closely to those in the English coal fields. The grain of the rock assimilates, and the characters which usually distinguish fruitful mineralogical strata are all present, whilst those met with in the sand-stone of the other collieries, are very unlike the usual ones accompanying coal in England, although the shales are similar, and contain the usual floriform and herbaceous impressions of vegetables; these are also here found both in the shales and in the

sand-stones. This pit is within a hundred yards of the great Salmah basaltic dyke, and at a distance of 600 yards lower down the river is the accompanying dyke at Bharah. They run to the south-westward nearly, but not quite parallel. One of these is traceable to the neighbourhood of Telindah, where is an abrupt conical hill, an offshoot of those hills which constitute the western boundary of the coal field all the way up to Pachete and towards Ramghur. The other dyke is traceable to the same range of hills near to the village of Rampore. The distance from Salmah and Bharah is about six miles.

Near to my pit, these dykes, which are each of them about twelve yards in breadth, cross the Damoodah river diagonally, and after continuing their course nearly a mile along its bank, they gradually tend towards each other, and the Bhara dyke intersects and crosses that of Salmah, at a place called Juggernat Ghaut. The Salmah one continues in full breadth across the country, through the village of Damarah, and several others towards the Adji, and is traceable for the distance of very many miles. The Bharah dyke, where a point intersects that of Salmah, continues its course through the country, but in a different direction, running towards Herahpore, and near to which it also meets another basaltic dyke of lesser magnitude, which I trace from Majeet, and they seem to have united, for I lose all trace of it thereafter. The dyke then turns a little more eastward, and continuing onwards, crosses the Benares road between Gopalpore and Neamutpore, and continues on towards Dabystan and to the schistose hills in that neighbourhood. It is these two main dykes which have caused the alteration in the strata, since the veins which are found on one side have not found corresponding ones on the other. Proceeding up the Damoodah on the south-west bank near to Berooee, there is a nullah called Tentooleah which falls into it, and which takes its rise in the igneous hills at the back or western side of the Pachete hill. This nullah skirts the base of the Beharrynauth hill; it is extremely rapid and rocky. Within this nullah the various small veins of coal met with in the pit at Salmah are here visible, and when close to the base of the Beharrynauth hill, a fault throws up the strata, bringing to view a vein of coal of about seven feet thickness and excellent quality. There are I believe not less than nine different veins which lie above this, and two rich veins of iron-stone. To attain this

vein of coal, my pit at Salmah is sinking. The proximity of the hill is such, that the strata around these are in much confusion, and at its base at the upthrow fault, the whole of the coal measures and their concomitant sand-stone are cut off at once; the country becomes immediately changed from a barren rocky surface to that of a fair cultivatable soil. A line tolerably direct from Beharrynauth hill towards that of Pachete defines the limits of the mineral field on the south-west, about six miles higher up the Damoodah.

Another similar nullah, sometimes called Alroosah, and sometimes Soonaree, runs much in the same direction towards Morelliah village, and in this nullah the same veins are discovered as in the Tentooleah; and are cut off by a similar upthrow fault, probably a continuation of that at Beharrynauth, bringing the same seven feet vein of coal within sight. About two miles above this, and upon the north-eastern bank, is a small nullah called Salinchy; here the strata are seen to be much troubled, and rising at a great angle. Here is situated the Chinacoory colliery, a vein of seven feet, which to me appears to be the same as that above alluded to, and is largely worked by Messrs. Carr, Tagore and Co.; this undertaking was originally begun by Mr. Betts. The vein of coal lies beneath a hard sand-stone rock, and admits of being worked similarly to the other collieries by the manner of stall and pillar, admitting thereby of a large produce being obtained. Around this place of Chinacoory, the strata are extremely deranged, and openings made in different places shew satisfactorily, that the dislocations extend to a depth sufficient to embarrass regular and continuous workings, without the aid of different pits to suit the different distortions. To the westward of this colliery, the vein is thrown up, and lost for a great distance. There is also here a basalt dyke, which runs thence towards the Adji. There is coal also discovered and worked as outposts, or detached workings by the same firm in several places, nearly opposite to Chinacoory on the western bank. Proceeding about three miles higher, and on the same side as Chinacoory, a small vein of coal is found at a place called Dheesherghur, and worked by Messrs. Carr, Tagore and Co. The land hence to the union of the Barracar river, seems to contain this vein near its surface. I cannot determine whether it be the same as Chinacoory, as the numerous faults and dislocations hereabouts have materially alter-

ed the strata, as is frequently the case from such causes, and reduced its thickness to about three feet. There is no information to be derived from the difference of the strata of rocks which accompany it, and usually serve to guide us and assist our judgment in such difficulties. We are now arrived opposite to the great Pachete Hill, and find ourselves in the country of dislocations and troublous faults and dykes. Here on the south-east bank of the Damoodah, as I before have stated, dislocations occur in every direction beneath that great hill, and between it and the river. Coal, which in my present state of survey I take to consist of two veins, is discovered all the way up to Gautcole, the open vein of it is seen in numerous places, and it is all of good quality. At Gautcole, the river navigation ceases for boats; it is impeded by rapids, and of such fierceness, as to preclude a hope of effecting any passage for boats higher up this river. It is convenient, therefore, to confine my description of the minerals to those which are discovered below this place, although the same continuous field of coal, though much more contracted in breadth, extending but a short distance to either side of the Damoodah, continues all the way to Ramghur, and to the hills separating it from Palamow, and it seems probable, that the coal fields in that district are coeval with the one of the Damoodah valley; but it is remarkable that the quality of the coal, as it approaches to the hills of evident igneous origin in that country, has been subjected to a change for the worse, and upon which I formerly reported in my survey of that country for coal by order of Government. The Damoodah, as I have before stated, has a range of conical hills running parallel with it at a distance generally of four or five miles from its south-western bank all the way to Beharrynauth hill, thence they keep at a greater distance, and stretch by the picturesque village of Baroo, which is the residence of numerous priests with temples raised, some on and some cut from the sides of these conical hills, which stretch away hence to near Rogonatpore. On the south-west of these hills, which I take it are protrusions through the sand-stone formation, and further towards Chota Nagpore, the coal formation is again met with, and it has been a matter of some doubt to me, whether it is not connected with that of the Coyle river and the Palamow coal field; and that the great disjunction of the three coal fields of Damoodah, Coyle, and Palamow is clearly defined by the range of hills before described,

running parallel with the river up to Ramghur. Coal is found in many situations in Chota Nagpore, though the veins are deficient in thickness. It remains to be seen, if others of more encouraging quality and sufficiently thick to be worked will be discovered in that wild country. I think it possible, that a previous connection has existed between the coal field of Palamow, Damoodah, and those countries beyond Chota Nagpore, towards the northern part of Cuttack to the sites described by Captain Kittoe, and which are traceable through a great extent of country thence towards the Coyle, and also through Chota Nagpore. The concomitant rocks and shales found in all these countries are extremely similar; nor is there wanting some peculiar veins of iron stone and fire clay, which point towards common and probably coeval formation. The country is so extensive, that years must elapse ere these conjectures can possibly be supported by unerring proofs. But it seems to me indisputable it is not a matter of very much interest as regards Chota Nagpore, as its distance, and the impracticable nature of the country, precludes a hope of finding any demand for its produce of coal.

Returning to Gautcole, and on the north-east bank of the river, we find continuous dislocations, the dykes now appearing to be of greenstone, and the country becomes covered with loose gravelly quartz pebbles and conglomerates. Coming downwards to the rocky island at the junction of the Barracar river, we enter it. This being a subdivision of the Agency of the South-west Frontier, or Chota Nagpore, is subject to the jurisdiction of the Poorooleah Agency. Soon after entering the Barracar, great dislocations are visible, and by the agency of some one of them, a fine vein of coal is brought to the surface of the ground, and upon which I have now two collieries at work. Similar dislocations have again thrown down the vein, and its extreme limit is but a few hundred biggahs. The nature of the mineral differs from any that is found in that part of the country, or within the Damoodah. The coal is of that description called *bending*, though not very strongly so; still it produces an excellent coke, such as is not obtainable from the coals found lower down the Damoodah. It has been found to be the very best description of coal used for steam engines, and far exceeding in value for that purpose any other of the country coals now brought to Calcutta. About four miles up the

Barracar on the west bank, and a little above the Benares road ferry, another vein of coal, about nine feet in thickness, is thrown up, and is now worked; but its quality is extremely low in the scale of fuel; and at about eight miles further from Barracar, and on the western bank, the sandstone formation is abruptly superseded by the schistose rocks and hills about Panraw, where the Benares road crosses the Barracar at the ferry of Bagooneah; and all around there, the ironstone measures rise out of the river, and are seen basseting out for some miles; the veins of iron are three, of a thickness two to three inches, and very poor in metal. These ironstone measures lie *over the vein of coal*, which is found on the opposite bank at Bermoory, as well as at a place called Ramnaghur, about three miles higher up, and it is traceable all the way across the country to the Adji river, thence across it towards the Beerbhoom hills, and down that river at various places near Jamalpore, Cherooleah, and Hedgelgureah, until the formation is wholly lost near Seedparah Ghaut. Nearly in a line from Begooneah, at which ferry are the great Jeyne temples towards Cherooleah, and at a distance from Mamutpore, on the Benares road of about four miles, is situated the village of Hattoreah Aytoorah. At this place the vein of coal crops out, as also does in many other smaller veins, and here was undoubtedly situated the first colliery ever opened in India by the agency of European superintendence. The remains of old crop workings are still visible near to the village, which were carried on by Mr. Heatly in 1774, or thereabouts, and it was from this place the coals denominated in those days Ramghur coals, were obtained; the whole of this country being at that time subjected to the rule of the Rajah of Ramghur; and it is an historical fact, that Mr. Heatly, at that time being politically employed by Government, captured the Rajah, and probably obtained a knowledge of the existence of coal through some attendant circumstances, and for working which, he was said to have obtained Government permission. It seems the coal was twice or thrice worked, and consumed in the arsenal of Fort William; the records of Government attest the fact, and the reasons assigned for discontinuance of operations were, that the coal did not answer the purposes for which it was required, the work was abandoned, and seems to have lain idle ever since. The line of one of the great dykes passes close

to this place, and to its agency probably the out-burst of the vein may be attributed.

From the description of this great coal field it will be seen, that there is no want of the mineral to be apprehended, and that the present collieries are fully capable of producing therefrom any quantity of coal that can be required; but it is not the difficulty of raising, and the production of coal that impedes supply. First, the necessary charge for European superintendence, which is required to conduct money operations, adds an extraordinary heavy charge upon the cost of production. Then comes the capability of river transport, and the difficulty of obtaining such a ghaut on the river as will admit boats to lie ready laden to start off with the mountain torrents. The rivers Barracar, Damoodah, and Adji, all rising in the hills, are navigable only for boats to descend for about ten weeks, and then only at such times as the rain in the hills affords sufficient water to produce a flood in the river; the rapid descent of the river beds seldom allowing a flood sufficient to float a laden boat to remain three days, but more usually two days, for unless a boat starts with the first or beginning of the torrent, it will be difficult for it to reach its destination at Omptah, where the coal depots are situated, before the water shall have fallen to a depth insufficient to bear the laden boat; but empty boats can proceed up the river at all times during the ten weeks. It is therefore necessary for a colliery to have on the river's margin such a ghaut, as where a pond of deep water is situated, and where laden boats can remain till the torrents admit of their departure. Such ghauts are extremely rare, and within the whole distance described on the Damoodah, there are not more than four or five such, where thirty laden boats can remain. It is with the greatest difficulty that the present collieries can manage to keep their extensive number of boats ready laden. This will be easily conceived, when it is recollected, that from the Nooneah Khal, where the collieries of Messrs. Carr, Tagore and Co. and those of myself are situated, if a flood succeeds after a period of ten days' absence of it, that a line of coal boats then departing extends frequently six miles in length, and is perhaps one of the prettiest sights that a stranger can witness. The channel of the river wherein alone the boats pass down, is extremely tortuous, very narrow, and constantly changing from the effects of the sudden rise and violence

of the torrent. Very many boats of the finest description in Bengal are lost by falling foul of each other; and once upset, these boats are usually dashed to pieces on the rocky sides of the river, or else sink with their load to an irrecoverable depth in the quicksands.

In order to be able to load these boats with rapidity, it is next of consequence to have the coals ready at the ghaut; this imposes the necessity of keeping the colliery at work throughout the year; the coals therefore are seldom sufficiently fresh when they are sent to Calcutta, for it is only those worked during the ten weeks' time that can be strictly so called. The consequence is, that the coal being subject to exposure for so many months to the heat of a tropical sun, has its innate tar and coal-oil greatly evaporated. This is the cause of its apparent inferiority to that imported from England, which is usually put on board ship within a day or two of its exit from the coal pit, and arrives at Calcutta without ever having been subjected to exposure. The coal of the district when fresh, will bear a favourable comparison with the average of coals imported from England, and that from Barracar is a very little superior to it ever imported. The great drawback to a cheaper supply of coals to the Calcutta market is attributable mainly to the two great causes of loss in weight by this exposure to the weather, for it is not only the nine and half months at the river ghaut, but there must afterwards be a twelve months stock at Calcutta to supply the market with, until the river again becomes navigable. These two periods will be found to be an average of *twenty months* to be subject to exposure; and the next is, that there is an interest of money on the outlay for the same period of time. I doubt much if any remedy at the present rate of demand for coals can be applied. Neither rail-roads nor canals with the present annual demand for a quantity of about 40,000 tons, (although the present collieries could treble their produce directly,) could compete with the comparatively cheap transport by the ungovernable river navigation, which bad as it is, still permits the coals to be conveyed to Calcutta at an average charge of seven shillings per ton. Although the general price for first class Steam coals is now rated at six annas per maund, or about twenty shillings per ton, whilst there arises a great deal of breakage into small and dust, which abstracts from its quality their price about one-fifth, so that the first class Steam coal may net to the

vendor twenty shillings per ton, still the average will not exceed sixteen, and although he has a heavy delivery charge to sustain, the miner at this price is supposed to be amply paid for his undertaking. Again, supposing the plan of a rail-road or a canal to be entertained, to what place should it direct its highest point, so that branches may be formed to the various collieries now open, and others which would doubtless follow? The most expensive part of the undertaking would lie within the line of the mineral field wherein the collieries are now working, which we may take at twenty miles in length. Any undertaking of this nature must be conducted to the extreme point, those most favoured at the lowest point would otherwise possess a virtual monopoly of supply. It is a just source of complaint, that at the present day the right of passage, or way-leave, to the river can be so exercised as to prevent the minerals from reaching the line of navigation of the river, which is an open, free, and untaxed road to the market of Calcutta; but any petty landholder possessing a biggah of ghaut land on the river's margin, may prevent the interior of the country for miles from pouring its resources to the capital, by what seems to me impolitic, withholding of a regulation to open these ghauts to public use. There is scarcely a canal or rail-road act in England but has some clause to oblige persons possessing lands applicable to such purposes, to accept a compensation for its use, settled usually by a jury of assessors. Why should not the rule for what is required for public purposes in that country, be applied to this? The present demand for about 50,000 tons by the removal of such obstacles as these, and many others of a similar nature, may be extended to double or treble that quantity in a year's time, if there was a demand for it, as the costs of the coal at the present day is much enhanced by these sorts of demand, which tell grievously in the accounts of a small concern. These observations apply to the whole of the river-ghauts.

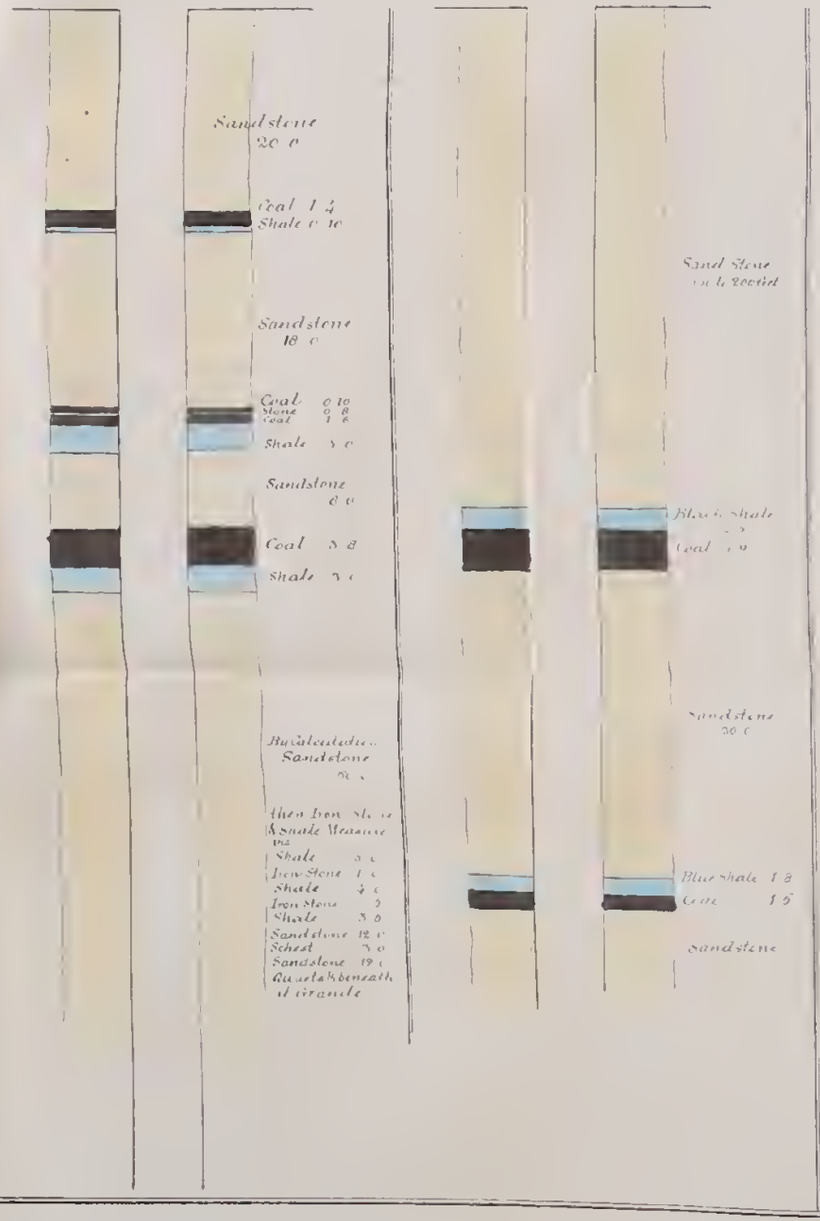
The iron worked within this mineral field is generally the produce of the thin veins which crop out on the surface of the ground, and is smelted now in but a very few locations; but the whole country has in different places been subjected to the workers of iron. Scarcely a spot of five miles square within this field but the scoriæ of iron are found in great quantities; and it would seem, that as the country

became subject to the cultivator, the iron smelter retreated further into the hills and forests. At present, the only place where iron smelting is carried on within this field is near to Gautcole, and beneath that range of hills, and towards Soosnah on the south-west side, and beneath the Beerbhoom Hills on the north-east; but no where east of the Barracar, and between the Damoodah and Adji.

Having thus described the country, I may mention, that in the Damoodah coal field, not a trace of limestone has ever been found, nor in either that of Chota Nagpore or Cuttack; and its absence throughout this and the neighbouring coal field of Palamow will convince any one, how different are the formations of this field from that in Sylhet, the Garrows, and Assam, where the noble limestone rock is found to accompany the coal throughout the whole of those countries. I cannot claim any honour, as others have done in the publication alluded to, for a discovery of coal as it is called, ten miles within the delta of the alluvial formation, and in the midst of the paddy fields; but I hope that what I have above stated, may prove instructive to such as think it worth while to inquire into the resources of the country. There is an account in the "Gleanings of Science," of the coal and colliery of Raneegunge, by Mr. Jones, and I should not have mentioned it, but it is erroneous in the extreme; and at the time he wrote it, I am certain it was based on very limited survey. It cannot be relied on at all, not even the section of the vein at Raneegunge, which is there made out to be seventeen feet, instead of half that thickness from the surface of the ground. We procure lime konkar, and this is the only calcareous production known hereabouts. Limestone, in the way of profit, would be far more coveted than coal; but we have it not. Fire clay of fair quality is found beneath the coal of some veins, but not universally. When properly selected, I have seen excellent fire bricks made therefrom, and have seen them used successfully in Messrs. Jessop's foundery. A porcelain clay is also found extensively near to the hills on the south-west of the Damoodah, but the admixture of foreign matter unsuits it for fine ware. I had some coarse pottery made from it in England, but they failed to produce fine ware. It is evidently decomposed rocks, and I take it, assimilates to that of China. In its native state, and by careful ablution, it might get rid of the impurities, but it is unadapted for pottery.

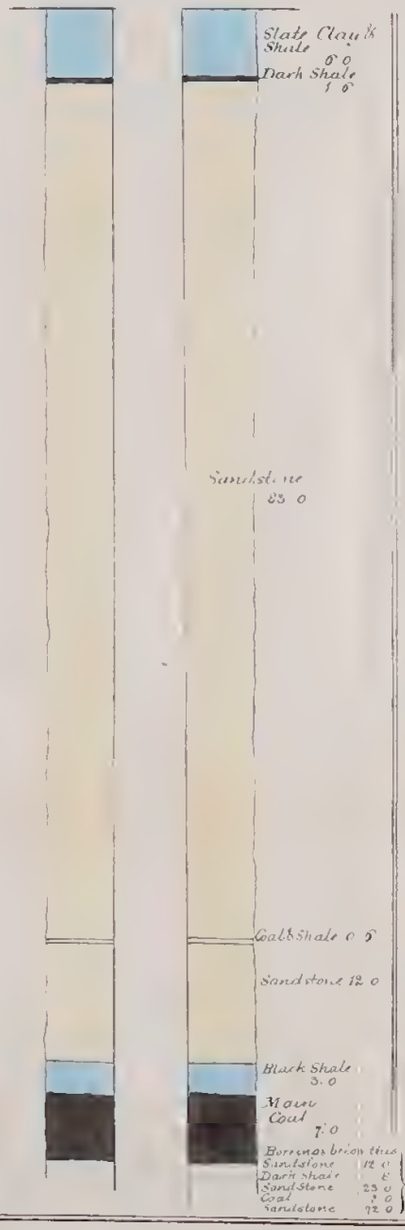

The
Damoodah Valley.
and
COAL FIELD
Sd. J Homgray 1854
Soane River
Reyle R
Manarawa
Gorga
Muapore
Palamow
Ramghur
Chatra
Barhee
Bhuthumsandy
Horinhata
Chitro
Parsnath
Sherselly
Dhanagur
Sarhal
Bellia Narainpore
Beerbhoom
Burdwan
Damoodah R
Jypore
South West Frontier
Jungle Mehals
Lodoosia
Kusaghur
Ponredeah
Maunder
Kusba
Kunchanagur
Scale of Miles
Variable
Dykes
Roads
Zillah Stations
do Boundary
4°30
4°
3°
2°
1°
24°
23°
Ballins lith. Press Wellesley Place

Singra Section of the Armanath Coal Field

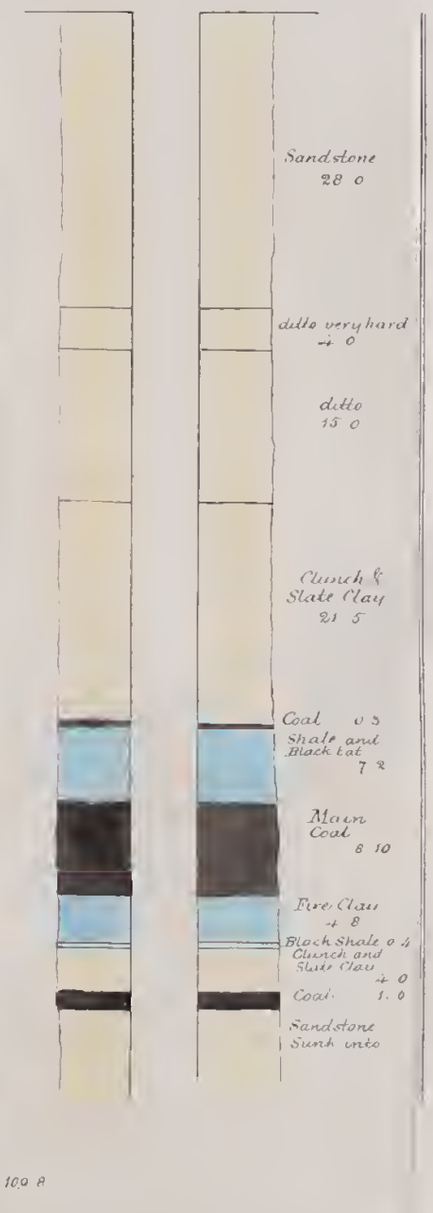


Palamow Section

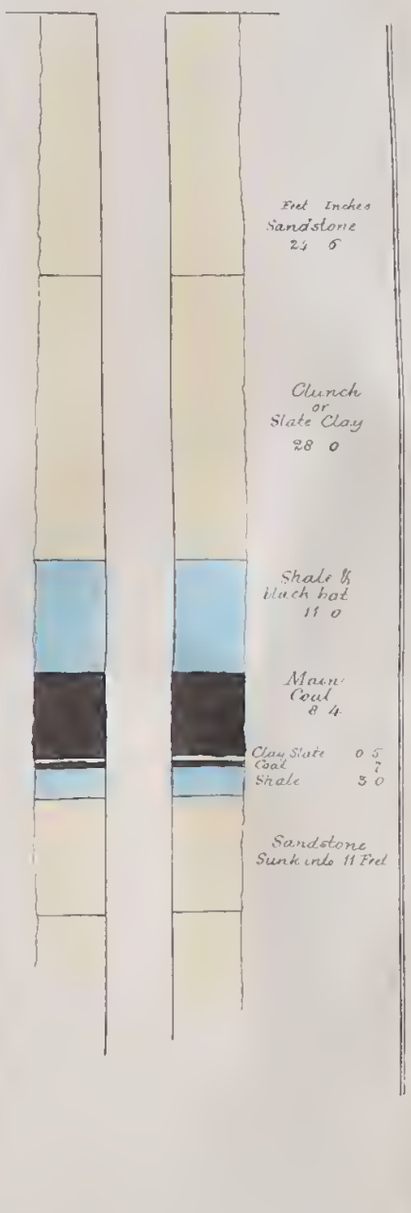
China Coory Section Pit and Berona



Narain Coory Section Enaone Pit



Rance Gunge Section N12 Pit



The hills around the south-west extremity, and near to the Subanreeka, contain a very poor description of copper, which is stealthily worked by the natives. The ore is very poor in metal, so also in the Beerbhoom district, and not very distant from where the coal is found in the Braning ruin. At a place called Doomka, there is lead found in several places, but that is also poor in metal. It probably is an outlier of the same plumbose formations as is found near to Deoghur, although twenty-five to thirty miles distant.

Talc is found in many places in the neighbouring hills, but the plates are not very large.

One might suppose, that where sandstone is found throughout this country, that some good paving stones might be obtained, but with the exception of two places, I have never met with any sandstone which separates in beds. At Cherooleah, on the Adji, large quantities were formerly raised, but were principally hewn from large boulders of sandstone and loose outlying rocks; the grain is very coarse, and the stone soft. It however answers well for common purposes, but is unfit to be applied to fine work.

Note.—Aytura, Chinacoory, and Damoully, (Mr. Homfray's Damooleah) were three of the six mines opened by Mr. Heatly in 1774. The scattered position of these over the country, shew that the field had been explored with some attention at that early period, and its most capable spots determined with judgment. Chirooleah also lies within the limits applied for and granted to Mr. H. So little appears to have been done since, as far as regards the examination of the great coal field of these districts, that though the early discoverers speak uniformly of Beerbhoom coal, and Pachete coal, and even Mr. Jones, "saw nothing to indicate the existence of coal in the Burdwan district," the publications of the Coal Committee invariably term this the Burdwan field, an error that might lure some sanguine capitalist into speculations like those of the Bexhill Colliery on the Hastings' Sand, chronicled by Sir John Herschel, (Disc. Nat. Phil. p. 45). The silence of the same authorities has compelled me to support a narrative of the early history of coal, (placed in Mr. Torrens' hands) by rather tedious quotations from public papers, as its authenticity might otherwise be called into question, since the Committee having easy access to Government records, and this being their special province, appear to be unacquainted with the facts.

S. G. T. H.

A Monograph of the species of Lynx. By EDWARD BLYTH, *Curator to the Asiatic Society.*

As the Lynxes are a group of Cats pre-eminently attached to frigid and mountainous regions, it is remarkable that none has hitherto been observed on the Himalaya, where the widely diffused *Felis Chaus* of Guldenstadt (vel *F. Kutas*, Pearson, *F. affinis*, Gray, and *Lynchus erythrotis*, Hodgson,) appears to be their only representative, this being rather a Lynx-like Cat than a true Lynx, though one of an unbroken series of gradations passing from the domestic Cat group into the present form, and which series is finally connected by *F. Caracal* with the typical or northern Lynxes—the Caracal according with the latter in wanting the small foremost upper false molar-tooth which exists in all other known Cats, while it is deficient in the facial ruff and mouchetures so characteristic of the animals under consideration.

That more than one species of this minor group inhabits the wooded Elboorz chain stretching eastward from the southern extremity of the Caspian, there is every reason to consider probable; and "the Lynx"* is included by Capt. Thos. Hutton in his enumeration of some of the mammalia of Afghanistan, *(Calc. Journ. Nat. Hist.* I, 558,) in which country "a large wild Cat, with a tendency to the Lyncean tuft on the ears," (most probably the *Chaus)*, is noticed by Dr. Griffith to be met with about Olipore (*Journ. As. Soc.* X, 978). Mr. Hodgson has obtained a species in Tibet (*Ibid.* XI, 276), which, from the dimensions ascribed to one of his specimens, would seem to be *F. cervaria*;† an animal chiefly found to the eastward of the Ural range, and rarely on the Caucasus, but which is known in Persia (according to M. Menetries) by the appellation *Vaarchach*. As I have had good opportunities of making myself acquainted with the various species of this group, and it appears to me that descriptions of them in this Journal will be of utility in enabling observers to discriminate any they may meet with, I shall pro-

* *In orig.* "three Lynx," a typographical error which, from the context, I read as above.

† Since writing the above, having seen Mr. Hodgson's coloured drawing of the animal in question, I can pronounce it to be *F. cervaria.*

ceed to offer an account of each of them, drawn up from personal examination of specimens in every instance.

The Lynxes may be characterised as merely short-tailed Cats, of middle size, with a tuft of lengthened hair at the tip of each ear, and wherein the small foremost upper false molar-tooth, which appears to be constantly present throughout the rest of the genus, is regularly deficient in the adult, if not in the young also. The Caracal excepted, they have a ruff of lengthened fur bordering the sides of the visage, beneath which is a pointed tuft pendent on each side of the throat, denominated their *mouchetures*. In general, they are light-made animals, with contracted flanks, and rather high on the limbs, and the fur of most of them is in winter long and very dense, having deciduary whitish tips, which more or less conceal the under-colour, but are gradually shed at the approach of summer, when the ground-tint has always a rufous cast (more or less bright, according to the species), and is variously spotted with black, the markings inclining to form oblique streaks on the flanks: the pendent mouchetures are white, with a black line near their outer border, beyond which the edge is of the hue of the body; the ears have the usual dark marks at the base and tip (common to most of the genus), and which shew very conspicuously in winter, from contrasting with the nearly uniform hoariness of the fur generally,—as does also a black tip to the short tail, which latter is more or less ringed above this, and has a very truncate appearance.

These typical Lynxes are solitary in habit, and frequent mountain-forests, where, however, they seek their prey chiefly on the ground; but climb trees with facility, to which they usually resort on apprehension of danger. They are timorous animals, but very destructive to lambs and calves, fawns, and specially to feathered game and hares; but they seldom attack larger animals, and only, perhaps, when urged and rendered desperate by famine. They commonly reside in some rocky cavern or burrow of their own excavation; where the female produces two or three kittens in the spring. Their voice much resembles that of the domestic Cat, only uttered in a fuller and deeper tone: and it may be remarked that the talons of these animals, though slender, are highly formidable, being adapted rather for prehension, or seizing their prey, than for tearing away the skin of it, which latter seems to be the chief purpose to which the Lion and Tiger apply these weapons,

after disabling their victim by a single blow of the tremendous paw, with the talons not exserted.*

As many as four species occur in Europe.

The Great Lynx (*F. cervaria*, Lin.; *F. borealis*, Thunberg, but not of Temminck). This is by much the largest and most powerful of the group, with teeth—the canines at least—fully equal to those of a Leopard, and a comparatively robust frame, appearing more so from the length and fulness of its beautiful fur, which is highly valued by the dealers in peltry. Its length approaches to three feet and a half, and height of the back upwards of two feet: the ears are rather small, only one inch and three-quarters long, and but slightly tufted; and the facial ruff is very conspicuous, the mouchetures hardly appearing below it, though nearly three inches in length. The upper canines are exserted an inch and a half from the gums, and are very stout in proportion. Fur excessively soft and dense, most delicately fine in texture, and two inches long, in winter, upon the back; of a lively rufo-fulvous, or bright rust-colour, underneath (or in summer), and tipped with glistening ashy-white in winter, imparting a fine lustre, besides which is a slight tinge of carneous more or less perceptible: it is marked with distantly placed irregular black spots, sometimes rather large, and more or less lengthened obliquely on the sides; three rows of these appear conspicuously along the croup; and the limbs have smaller spots, and are but little marked on their inner surface. The most esteemed skins have the spots small, and a lustrous greyish-white surface, with a distinct blush. The young, according to M. Temminck, are covered with brown spots in addition to the black ones.

This species is the *Siberian Lynx* of the furriers, and would appear to be principally found in Northern Asia, from whence the skins are mostly

* So far as I have observed, a Lynx's claw is always keenly pointed, whereas in wild-shot specimens of the other great *Feles* alluded to, the talons are often very much split and broken away at the extremity, evidencing the roughest usage, but may be peeled away underneath with facility till they become sharp enough for any purpose. The fact is, they continue growing, but, like a rodent's tusk, are of much softer substance behind or underneath than in front; and as soon as the point is broken away, a horizontal split commences, and the under lamina soon shreds off: the point, being harder, is apt to grow inconveniently long; and hence a common practice of all the genus, which the house Cat is too fond of performing upon the legs of chairs and other furniture, the Jaguar always resorting to a particular individual tree of the forest for the same purpose, and the Puma (as noticed by Mr. Darwin) making deep scores in the bare hard soil of Patagonia.

brought to Moscow. On the Caucasus, it seems to be rare :* and it doubtless extends northward along the forests of the Ural, being likewise found, though as a rarity, in Scandinavia, where it is designated *Kat-lo* (or Cat Lynx). I suspect it to be the Tibetan species of Mr. Hodgson.† Pontoppidan, in his 'Natural History of Norway,' by some inadvertence, asserts that this *Kat-goupe* "is scarcely half the size of the next, or *Warg-goupe*." Of its particular habits I have met with no information.

The Red Lynx (*F. Lynx*, Temminck, but not of Linnæus and Nilsson; *F. virgata*, Nilsson). This is the ordinary European species, which alone is found in the central parts, though now very sparingly, extending from Scandinavia to Naples, and to the Pyrenees, whence it may be suspected to have wandered into Spain, though it is not known to have occurred in that country. It is a long limbed animal, appearing so more particularly in summer, when its coat is short; the pupils of its eyes close vertically; and the facial ruff is moderately full, with the mouchetures appearing conspicuously below it. A fine living male stood nearly two feet high at the croup, with a length of about three feet to the tail, the latter about six inches more; ears fully three inches, with tufts an inch and a half, and the mouchetures an inch and three quarters. The fur is short in summer, but in winter is much longer, with pure white tips almost concealing the bright rufous under-colour: the latter is darker along the middle of the back, paler on the sides, and the under-parts and inside of the limbs are white; the body-markings are obscure, and in some individuals not a little resemble, when sufficiently brought out, those of the Ocelot (*F. pardalis*); forming dusky spots on the limbs only, and faint ocellated streaks descending obliquely backwards on the sides, the inferior border of which ocellations is much more strongly marked (as in various other species), and in some specimens almost solely discernible. The tail is rufous above, whitish underneath, and rather largely tipped with black: the borders of the eyes are white, with a black line proceeding obliquely backward and downward from their

* It is, however, the only species that was noticed on the Caucasus by M. Menetries, who obtained the spoils of one at Bakan, which he was positively assured was killed in that country.

† See Note to p. 18.

outer corner; the upper lip is spotted, and the under one margined, with black; and the facial markings resemble those of the other streaked species of *Felis:* irides greenish-hazel. The young resemble the adults.

This Lynx is the commonest species of the forests of Scandinavia, and the only one which is occasionally met with in the southern parts of that country during severe winter weather. It is there termed *Warg-lo* (or "Wolf Lynx"); that is, in Sweden, being the *Warg-goupe* of Norway. In former times it appears to have been very generally diffused over Central Europe, and it is still sparingly found in the wilder mountain forests of Germany, Poland, Hungary, Switzerland, (where M. Schinz mentions that it is extremely rare), and according to M. Temminck in Italy as far as Naples, and very accidentally France. Baron Cuvier notices its occurrence on the Pyrenees. In Russia it is more numerous; and M. Guldenstadt states that it is common upon the Caucasus,* whence it probably spreads eastward and northward into Central Asia. An interesting notice of this animal occurs in Major Lloyd's 'Field Sports of the North of Europe' (II. 139, *et seq*). This author does not appear to have been acquainted with more than this one species, observed both in summer and winter dress, which he rightly refers to the same animal; and concerning it, he mentions that "they are to be found in some abundance in all the more deeply wooded districts of Scandinavia. They are usually to be met with singly, or at most in pairs, unless it be, perhaps, that the mother is followed by her cubs. They generally confine themselves to the wildest recesses of the forests, and are rarely to be seen in the vicinity of inhabited places.

"The period of gestation with these animals is from eight to nine weeks, and the female brings forth about the beginning of May: this is either in the cavity of a rock, or in other sheltered situations. It is said that the mother [like the rest of the genus] gives her whelps living animals, the better to initiate them in the art of killing their victims.

* I follow Temminck in referring Guldenstadt's *F. Lynx* to this species, although the evidence is not very conclusive. Guldenstadt defines it as "capite et corpore albidô rufô maculatô, caudâ obsoletè annulatâ, apice nigrô;" which applies almost as well to *F. cervaria*. It is probable, however, that the present species is intended.

"The Lynx is a most destructive beast. He kills the young of Elk, Deer, Roe-buck, Hares, &c., and also the Capercaili, Black-cock, and other birds common to the northern forests. He likewise destroys the smaller domestic animals, such as Sheep, Goats, Calves, &c. When he gets among a flock of Sheep or Goats, it is said that, if he be unmolested, he slaughters the whole of them. He has been known to attack and kill even a Horse.* The Lynx, it is asserted, never touches carrion or putrid flesh," nor, indeed, do any of the genus, unless very severely pressed by hunger, when even a Tiger has been seen to make a meal off a putrid carcass.

"The Lynx is little dangerous to the human race. I never heard of his attacking a person, unless molested in the first instance. If he be wounded, he will sometimes turn upon his antagonist [much smaller species, as the British Wild Cat, will do the same]; indeed, more than one instance has come to my knowledge, when, thus circumstanced, he has severely lacerated his assailant. It is not difficult to kill him with a good Dog, for, if closely pursued, the animal usually takes refuge in a tree, which he ascends with the agility of a Cat. In that situation, it is, of course, easy for the sportsman to destroy him. If the Dogs take the Lynx by surprise, and he is unable to shelter himself either in a tree, or in the cleft of a rock, it is said that he throws himself on his back, and defends himself desperately with his claws. He is, however, as much afraid of a bite in the foot as a Lion."

It must be to this species, also, that Pontoppidan's notice mainly refers, when speaking of the Scandinavian Lynxes, he writes — "These animals go out like the Wolf, except that they do not appear so publicly in the open flat country, but keep more to the woods, and lurk in holes of the earth, which they dig for themselves deep and winding; but they are driven out with fire and smoke. In the day-time they lie hid, and steal upon their prey, which they watch for, crouched up like Cats, at the entrance of their holes. They are very nice in their food, and of a Sheep or Goat do not eat more than the head or udder; by which circumstance one knows what animal has been there. Though they always kill, they eat little in the increasing moon [?], but in the decrease are more ravenous, and will hide or bury the carcasses like a

* This was probably *F. cervaria;* but it will be remembered that the Norwegian Horses are remarkably diminutive.—E. B.

Bear. The wild Cat is their worst enemy, for its almost constant employment is to look out for them in their holes, and steal their prey from them. They are very cunning in undoing a sheep-fold, where they help themselves very nobly. When attacked by a Dog, they throw themselves immediately on the back, in the manner of a Cat, and turn up the fore legs, to be the better able to defend themselves; the Dog on this lays hold, but the Lynx *(Goupe)* then makes use of his sharp claws so effectually, that he flays his enemy alive."*

The specimens of the *Red Lynx* which I have seen, in captivity, have all been more or less tame, especially a fine male which was living in the Zoological Society's Garden at the time I left London; this was perfectly gentle and familiar, as much so as any domestic Cat; it courted notice in the same manner as that animal, by purring and arching up the back, and raising its short tail, which at other times was ordinarily carried closely appressed, as in the Caracal: the latter animal I have also repeatedly seen quite tame; but not so the Bay and Pardine Lynxes, which were shy and mistrustful, for ever growling and spitting at persons who approached them, and (the individuals) seem-

* "It happened lately," continues this author, "that a *Goupe* making his way into a sheep-fold, was discovered by a sly old he-Goat, who perceived his subterraneous track, watched him narrowly, and as soon as he had come forth, before the body could be got out, butted him, and gave him such home-pushes, that he laid him dead in the grave of his own making."—*Nat. Hist. of Norway*, II. 21.

Here it may be remarked, that the existence of the European Wild Cat in Scandinavia has been denied by later authorities, though Pontopiddan further states, (at p. 8,) that "we have Cats both tame and wild; the latter are very large, and their skins bear a good price; they live by watching birds upon the trees, and then seizing them with a sudden spring." This is quite the habit of the British Wild Cat, which usually lies dozing or watching for prey upon a low pine-branch of its own colour, where it cannot easily be discerned. M. Nilsson (as cited by Major Lloyd) states, however, that the true Wild Cat does not inhabit Scandinavia, though a stray domestic Cat may now and then be met with in the forest. The *F. Catus* of Linnæus is clearly the domestic species; and the Faunas of Bilberg and Retzius throw no distinct light upon the subject, failing to distinguish the two species apart; which is also the case in Müller's *Prodromus*, where reference is, however, made to Von Aphelin's Work, (II. 299,) which I have had no opportunity of consulting. M. Ménétries notices that the European Wild Cat is not rare in the Cisalpine forests of Caucasus, where the Russians style it *Kowka*, or Wild Cat; a name which, according to Pallas [following Guldenstadt], is bestowed on *F. Chaus*. It descends in winter to the Steppes. Temminck asserts that, in Hungary, Russia, and the Asiatic countries, this animal attains a larger size, and yields a more esteemed fur, than in Western Europe; though I incline to doubt whether the largest British specimens are anywhere surpassed.

ingly altogether untameable; so likewise are a couple of kittens of *F. Chaus* which are now more than half grown, and which I have possessed from the time they could scarcely crawl, and have uniformly tried to subdue their savage disposition, but wholly without success. They will allow me to touch them, but never suddenly or abruptly, nor do they ever fail to greet me with a spiteful hiss, and when I venture to smooth their fur, they throw back their ears as if frightened, and resume their growling and spitting the moment I take my hand off; and so it has been with them from the very first, when they could not have had their eyes open many days. Lieut. Tickell tells me, that he also has found the *Chaus* thus utterly untameable.

The Pardine Lynx *(F. Pardina,* Oken and Temminck). If the preceding species does not extend its range into the Spanish peninsula, its place is there supplied by another, remarkable for the beauty of its spotting, and the length of its pendent mouchetures, which is not known to occur out of that country. The Pardine Lynx is inferior in size to the ordinary Red species, but measures upwards of two feet and a half to the tail, the latter six inches more; and height of the back about a foot and a half, or rather more. The ears are two inches and a half long, or with their tufts three inches and three-quarters; and mouchetures two inches and a quarter. The fur is short and soft, three-quarters of an inch long upon the back, and of a vinous-fulvous colour, paler on the under-parts, and very handsomely spotted with black; the markings inclining to form linked ocellations on the sides, which are of a deeper colour within than the general ground-tint, as usual in all ocellated markings. On the limbs are round spots, which become smaller and tend to group into ocellations above them. The tip of the lower and margin of the upper lip are black, above which the latter is spotted; and the back of the ear is grey in the centre, broadly surrounded with black; the margins of the eyes being white as usual. The mouchetures, also, are conspicuously white, finely set off by the black line near their outside; but there is no other white except on the throat. I doubt whether the fur is ever much tipped with whitish in winter, though there is probably some appearance of it. The ground colour of the young is paler, with the spots less intense.

To the continental furriers, this species is known, according to M. Temminck, as the Lynx of Portugal. Col. Sykes obtained two

skins (of an adult and young) at Seville, where they cost him thirty reals, about six shillings and three pence. "In Andalusia, whence the specimens came, the animal is called *Gato Clavo* (*Clavo* meaning the pupil of the eye), illustrative of the spotted character of the fur. Some peasants in Andalusia make short jackets of the skins. The animal inhabits the Sierra Morena."* M. Temminck suspected that it might also be found in Sardinia, and perhaps Sicily; while the Lynx of Italy and Naples is known to be the Red one. He further conjectured that it may inhabit Turkey and the Levantine countries. No notice of it occurs, however, in Sr. Cetti's work on the quadrupeds of Sardinia, where the only wild Feline appears to be a feral race of the Domestic Cat, with generally black fur, as noticed by Azuni, and which is numerous in all the wooded districts of that island. The specimen here described is a fully adult male, received when young by the Zoological Society from some part of Spain, and which lived till it attained complete maturity in their establishment. The anterior false molar proved to be wanting in its upper jaw, as in all the allied species here described.

The Arctic Lynx (*F. Borealis*, Temminck, but not of Thunberg; *F. Lynx*, Linnæus and Nilsson; *F. Canadensis*, Geoffroy). This fourth European Lynx appears to be common to the wooded districts of the extreme north of both continents. It is readily distinguished by the indistinctness of its markings generally, including those of the limbs, though on the belly there are spots which, in some individuals, are tolerably distinct; and particularly by the shagginess of its paws, the fur covering which is remarkably long and dense, recalling to mind the feet of some of the Arctic birds, as the great Snowy Owl and certain Ptarmigan. This animal bears even a further resemblance to the Owls, in the manner in which the hair of its face meets to form a mesial ridge between the eyes, which is very strongly marked; whereas in other Cats, although some trace of this may generally be found, it certainly requires to be looked for, to be observed. Its length is about two feet and three-quarters from nose to base of tail, the tail with hair only four inches more; height of the back

* *Proc. Zool. Soc.*, 1838, p. 113. From the same mountain range, a Mungoose (*Herpestes Widdringtonii*, Gray), allied to the Egyptian *H. Ichneumon*, has recently been described by Mr. Gray, in the 'Annals and Magazine of Natural History' for March 1842, p. 50, certainly a very unexpected addition to the Mammalia of Europe.

somewhat exceeding a foot and a half. The ears are two inches long, with copious tufts that sometimes attain to two inches, and the ruff and mouchetures are considerably developed, the latter measuring three inches in length. The coat generally of this species is in winter long and very dense, measuring, at that season, an inch and three-quarters upon the back: in summer it is of a yellowish-buff colour, greyish, or mixed with white, having black tips along the middle of the back; and in winter, (or when in season, as the furriers style it,) it is silvered over with hoary tips, the black extremity of its very short and particularly truncate tail, and the black tips and long pencil-tufts of the ears, contrasting in a striking manner with the almost uniform hoariness of the fur generally; its paws have a wide spread, and look immense; their aspect being quite different from that of any of the others. The facial markings of this species are scarcely, even when at all, perceptible, and of numerous heaps of the skins which I have examined, it was very seldom that any trace of spots could be discerned, even upon the limbs: the fur of the under-parts, however, which is longer, has some distantly placed rather large black spots upon a white ground, resembling those of the next species, and which are more or less brought out in different individuals.

This Arctic species, according to M. Nilsson, is the *F. Lynx* of Linnæus, as indeed was indicated by the words "manus amplissimæ," though the expression "corpore rufescente maculatâ" certainly applies much better to the *F. Lynx* of Temminck, which, as being now generally known by that appellation, I prefer still to style so, perceiving no advantage in altering the established denominations with M. Nilsson. M. Temminck united the Scandinavian and Hudson's Bay animals, after comparison of a vast number of skins; and M. Nilsson's coloured figure of a Swedish specimen might pass equally for that of an American one: it may, nevertheless, surprise, that this species is not generally included in the catalogues of observed mammalia, which are appended to the narratives of the different Polar expeditions; but the reason appears to be, that it is everywhere rare near the sea-coast, keeping to the wooded districts of the interior; Captain Back being the only navigator who notices it.

The Arctic Lynx is confined to the northernmost forests of Scandinavia, where it is known as the *Rislo*, or *Raf-lo* ("Fox Lynx");

and it appears to extend throughout the corresponding latitudes of the whole eastern continent, spreading perhaps to the southward in Siberia, and along the forests of the Ural. It is doubtless the species common in Kamtschatka, and it takes a wide range on the western coast of North America, as the Zoological Society possess a specimen from California. In the United States, it appears to be only known as a very rare straggler; and the only recorded instance which I know of its occurrence within the northern territory of the Union is published in Silliman's 'Journal' for 1837, p. 194, where a specimen is mentioned to have been tracked and shot, at Southington, Connecticut. Its weight was thirty-two lbs. and length nearly three feet; the tail about four inches. "Though not entirely agreeing with Dr. Richardson's description", remarks the writer, "it was probably *F. borealis*". There is no other known species which it could have been. Hearne remarks, that "it is very rare to the North of Churchill [on the *barren-grounds?*], but is there exactly the same as those found to the South-west. They never approach near the settlement of Hudson's Bay, and are very destructive to Rabbits [small American Hares], seldom leaving a place which is frequented by them till they have killed nearly all."—"It is the only species of the genus," remarks Dr. Richardson, "which extends north of the Great Lakes, and eastward of the Rocky Mountains. It is rare on the sea-coast, and does not frequent the barren-grounds, but it is not uncommon in the wooded districts of the interior, since from 7,000 to 9,000 skins are annually procured by the Hudson's Bay Company. It is found on the Mackenzie River, as far north as latitude 66°. The early French writers on Canada, who ascribed to it the habit of dropping from trees on the backs of Deer [which Brickell and Catesby likewise assert of the Bay Lynx, being further rendered probable by the known sanguivorous propensity of the ordinary European species,] gave it the name of *Loup Cervier;* but the French Canadians now term it indifferently *le Chat* or *le Pechoo*".

Dr. Richardson further relates, combining the descriptions of Hearne and Dr. Godman with his personal observation, that this Lynx "is a timid creature, incapable of attacking any of the larger quadrupeds, but well armed for the capture of the American Hare, on which it chiefly preys. Its large paws, slender loins, and long but thick hind legs, give it an awkward clumsy appearance. It makes a poor fight

when it is surprised by a hunter in a tree, for though it spits like a Cat, and sets its hair up, it is easily destroyed by a blow on the back with a slender stick, and it never attacks a man. Its gait is by bounds, with the back a little arched, and lighting on all the feet at once. It swims well, and will cross the arm of a lake two miles wide; but it is not swift on land. It breeds once in the year, and has two young at a litter. The natives eat its flesh, which is white and tender, but rather flavourless, much resembling that of the American Hare." The latter accords with the statement of Dr. Shaw respecting the flesh of the Lion, which this author compares to veal; and it is borne out by the personal experience of Mr. Darwin, in the instance of the Puma, which is commonly eaten by the Guachos of South America. Buffon, therefore, may have been writing from supposed analogy when he asserted that the flesh of the common European Lynx, "like that of other carnivorous animals," is not good to eat.*

* It is indeed a question, to what extent the excessive repugnance with which the idea of eating the flesh of Carnivora is usually entertained, be not mere educational prejudice, as an immense host of authorities might be cited to testify. Mr. Darwin, as above noticed, in his extremely interesting 'Journal' (p. 135), relates, "At supper, from something that was said, I was suddenly horrified at thinking I was eating one of the favorite dishes of the country, a half-formed calf, long before its proper time of birth. [This reminds one of an esteemed dainty of the ancient Romans; namely, a gravid *uterus suillus!*] It turned out to be Puma; the meat is very white, and remarkably like veal in taste. Dr. Shaw was laughed at for saying that the flesh of the Lion is in great esteem, having no small affinity for veal, whether in colour, taste, or flavour; such, certainly," continues Mr. Darwin, "is the case with Puma. The Guachos differ in opinion, whether the Jaguar is good eating; but are unanimous in saying that Cat is excellent."

Similar testimony in favour of Dog's flesh might be adduced, and not only as regards the meat of such as are reared exclusively on vegetable diet, but of those which take their chance and find their own subsistence as they may. Mr. Townshend (in his recent 'Narrative of a Journey across the Rocky Mountains' of North America) states, that he has often eaten and relished it, and has no other objection to this diet than the sentimental one of repulsiveness, at having so faithful a servitor and friend of man heartlessly butchered to appease his appetite. In Norway, I may remark *en passant*, a breed is reared solely for the sake of their fur, which has evoked a similar remark from De Capel Broke and other tourists in that country. Capt. Lyon mentions, of the Arctic Fox, that "the flesh, which was very fat, had so good an appearance, that many trials were made of it. All were horrified at the idea of eating Foxes, but very many soon got the better of their delicacy. Not being myself very nice, I soon made the experiment; and found the flesh much resembling that of kid, and I afterwards frequently made a supper of it."—*Private Journal*, p. 90.

Of the quality of *Viverridæ* meat, I do not remember to have seen or heard of any remark, nor do I suspect it would be otherwise than rank and unpalatable: but of the *Plantigrada*, or Bears, Raccoons, and their allies, and of the Badger tribe, all of

The Bay Lynx (*F. rufa*, Guldenstadt; *F. maculosa*, Vigors and Horsfield, *Zoological Journal; Mississipi Lynx* of Buffon, and "Wild Cat" of the United States of North America). Size averaging that of the Pardine Lynx, or smaller than the last species, with much shorter fur, and a very full facial ruff, the mouchetures not appearing below it. From nose to base of tail, it measures about two feet and a half, the tail five inches, and height of the back about sixteen inches; ears an inch

which are vegetable-feeders to a considerable extent (as indeed are also most *Viverridæ*), abundance of favourable testimony might be collected. Vide Major Lloyd's 'Field Sports of the North of Europe,' II, 46, and the Hon'ble C. A. Murray's 'Travels in the Western Regions of North America,' II, 59. Even of the fetid Skunk of the latter continent, we are informed, in Carver's Travels (p. 452), that "Europeans who have fed on them, after the receptacles of the odorous fluid had been carefully extracted, have found them very sweet and good." If this animal be seized and lifted by the tail, it cannot squirt its fluid, and, like other creatures with a sensitive nozzle, it is easily killed by a blow on the snout. Formerly it was customary to eat the Otter, on lenten days, *for a fish!*

With regard to Bear's meat, it should, however, be mentioned, that the flesh of the great Polar Bear appears to have sometimes proved decidedly unwholesome; yet in the Appendix to Capt. Parry's 4th Voyage, it is stated to be "free from any disagreeable taste; it proved a valuable and timely addition to our stock of provisions, and served materially to restore the strength of the party." Hence it may be suspected that the effects resulting from the use of this aliment, noticed in the narrative of one of Capt. Ross's Voyages, are attributable to some particular food the animal had been eating, or even, possibly, to some adventitious circumstance affecting the tone of the digestive operations in the men.

Among the *Insectivora*, Cuv., the respectable editor of the 'Literary Gazette' gives his personal testimony that the flesh of the Hedge-hog is excellent; and there is a notice, in the 'Magazine of Natural History', of a Mole-catcher who was in the habit of eating the Moles he caught, and said that "if folks generally knew how good they were, but few would fall to his share." To cite an instance from among the *Edentata*, Cuv., the Armadilloes are exceedingly foul feeders; yet all who have partaken of it agree that one, "roasted in its own shell," is most delicate-eating.

In the feathered class, I remember that M. Audubon declares, that he has never eaten the flesh of Cormorant, nor, so long as he can help it, will he ever do so, or words to that effect; but M. Schomburgk has assured me that he has frequently eaten of the Cormorant of Guiana, which is really very good, after having been (like other water-fowl) skinned previously to dressing: and very lately a gentleman informed me that he had repeatedly partaken of Anhinga (*Plotus*), a genus closely allied to that of the Cormorants. Indeed, some London readers must not be too sure that they have not themselves feasted off a plump Cormorant; for I have been credibly informed of an instance of a man carrying a row of these birds upon a pole through the streets, and seeking to vend them to the Londoners by the familiar cry of "wild Ducks, wild Ducks, oh!" Of the egg of the Cormorant, the same friend has assured me, that he was much surprised to find how good they were; and there is reason to suspect that any eggs of birds described as otherwise, were none of the freshest when tasted.

It is said that a Buzzard, and particularly a Pern, or Honey Buzzard, is esteemed an excellent dish in some parts of France.

and three-quarters long, or, with their tufts, half an inch more; and mouchetures, which barely acuminate below the considerably developed ruff, an inch and three-quarters at most. The fur is seldom more than an inch long upon the back, or at most an inch and one-eighth; and is of a grey-brown colour, more or less tinged with rufous, much as in a rusty tabby Cat, or as in the *Chaus;* and marked all over with small round dark spots, indistinct on the back, and, in some, all over the body, but always well-defined on the limbs, and more or less so above them; enlarging and becoming deeper-coloured downwards,

People should really be more particular than they are in eating fish, lobsters, &c., to be consistent in following out their notion that the flesh of all carnivorous animals is unfit for the table. Many English gourmands would sicken at the idea of a dish of Snails, which in Hungary, more especially, is esteemed a delicate and is a very frequent viand, so much so that not a few of the peasantry even pay their rents with them (vide Mr. Paget's recent 'Travels in Hungary and Transylvania'); but a Hungarian lady would be fully as much horrified at the thought of swallowing an Oyster, and would, at least, have this advantage over the British epicure, that Snails are vegetable-feeders. One can fancy a civic *bon vivant* commiserating the barbarism of the Persian Princes, who not long ago visited the British metropolis, and testified their abhorrence at the custom of eating Turtle! But that we civilized and enlightened *Carnivora* are altogether free from irrational and totally unfounded misapprehension on the subject of eating the flesh of creatures of prey is, the reader will perhaps begin to think, a little questionable, if he do not go so far as to imagine that a hint might be profitably taken on this subject, as on some others, from the philosophically omnivorous Chinese. At all events, those who are disposed to rail at others for their fastidiousness about eating pork, may ponder awhile upon the reasonableness of their own aversion to partake of various other kinds of flesh, and hesitate before condemning as "unclean" and improper food, what they only presume to be such as a mere matter of course, stigmatizing, by the appellation "carrion," what, in truth, they might have eaten with great relish, had the tide of conventional prejudice happened to flow in the opposite, direction.

A-pro-po's to the foregoing remarks, I have just chanced to meet with a notice in Ellis's 'Tour through Hawaii' (p. 319), which is worthy of being here transcribed. It is well known that the Polynesian natives generally, as well as the Chinese, each rear a particular breed of Dogs for the table, though mainly on vegetable diet: and the *canivorous* propensity is retained by the Chinese in this country; at least I lately saw a well-dressed China-man bargaining for a Corsac Fox in one of the Calcutta bazars, and doubt not that he was prompted thereto by his palate. "Numbers of Dogs, of rather a small size, and something like a terrier," writes Mr. Ellis, "are raised every year as an article of food [in Hawaii, olim *Owhyhee*]. They are mostly fed on vegetables; and we have sometimes seen them kept in yards, with small houses to sleep in. A part of the rent of every tenant who occupies land, is paid in Dogs for his landlord's table. Though often invited by the natives to join them in partaking of the baked dog, we were never induced to taste of one. The natives, however, say it is sweeter than the flesh of the pig, and much more palatable than that of goats or kids, which some refuse to touch, and few care to eat."—*Chacun à son goût. De gustibus,* &c. &c.

and often uniting, more or less, to form transverse streaks on the limbs, similar to those visible on their inner aspect. The belly is clad with longer hair, which is white, with rather large black spots; the summit of the back, and across the shoulders, are darker; the facial markings are more or less brought out, different individuals varying a good deal in this respect; the ears have the basal dark mark distinct, which is not generally the case with the last species; and the tail is obscurely ringed to near the end, where there is a distinct black ring, and beyond it a lateral black spot, which joins that on the other side above, leaving the extreme tip white: the under-surface of the paws and tarsus are conspicuously brown-black (as in *F. chaus*), which is also the case, but in a less degree, in *F. pardina;* and the irides are pale bluish, the pupils of the eyes closing circularly (?). The young (as figured by F. Cuvier by the appellation of "Chat à ventre tacheté,") are clouded with much larger spots, of a darker colour than the general ground-tint.

The Bay Lynx appears to be pretty generally diffused in suitable districts throughout the United States, as more especially in the forests of the Alleghanies and other mountain ranges; extending southward into the Floridas and Mexico. It is also found in California, and about the Columbia river, but it does not occur in the parallel of Labrador. Like the rest, it chiefly inhabits the less frequented parts of the forest, where, in the season, it "makes night hideous" with its loud caterwaulings. It is very destructive to the fawns of the Virginian Deer, young Pigs, Hares, &c. and especially to feathered game, including the wild Turkey in the south. Brickell and Catesby assign to it the habit of dropping from trees upon the backs of Deer, and sucking the blood of its victim. When urged by hunger, it has been often known to follow the footsteps of a hunter, who happened to be carrying the bleeding carcass of a Deer, and become at length so excited, by sniffing and licking at the drops of blood on the ground, as to spring up at the dead animal, and sometimes lacerate the bearer with its talons; but the next moment it will be off and up the next tree, and pursue its course along the forest-boughs with such celerity, like a Puma or Leopard, that, if not shot down at once,—and a wound that does not disable it may exasperate the creature to attack with fury,—it has every chance of escape. When angry, it erects the facial ruff, which helps to impart a savage aspect to the animal.

The above are the only described species of Lynx—putting aside the Caracal—in which, I confess, that I have any confidence, though several others have been indicated by M. Raffinesque as inhabitants of North America, which, at most, I suspect, were varieties of the two last.* According to Dr. Richardson, the late Mr. Douglas was of opinion "that there are more than one undescribed animal of this genus inhabiting the countries bordering on the Columbia. The skins procured in that quarter are generally carried to the Chinese market, without passing into the hands of European furriers." The following passage, however, from a paper on the fur trade, published in Silliman's 'American Journal of Science,' (XXV, 311,) will excite surprise and doubt that any animal so conspicuous should still remain unknown to naturalists. "The fur-countries, from the Pacific Coast to the Rocky Mountains, are now occupied, (exclusive of private combinations and individual trappers and traders,) by the Russians, on the north-west, from Behring's Strait to Queen Charlotte's Island, in north latitude 53 degrees, and by the Hudson's Bay Company thence, south of the Columbia River; from which Ashley's Company, and that under Capt. Bonneville, take the remainder of the region to the Coast of California. Indeed the whole compass, from the Mississipi to the Pacific Ocean, is tracked in every direction. The mountains and forests, from the Arctic Sea to the Gulf of Mexico, are threaded, through every maze, by the hunter. Every river and tributary stream, from the Columbia to the Rio del Norte, and from the Mackenzie to the Colorado of the West, from their head springs to their junction, are searched and trapped for Beaver.

"Almost all the American furs, which do not belong to the Hudson's Bay Company, find their way to New York, and are either distributed thence for home consumption, or sent to foreign markets. The Hud-

* It is well known that the morbid eagerness of this eccentric Siculo-American naturalist to distinguish himself as the discriminator of overlooked species of animals and plants amounted, latterly, to decided mania, insomuch that the conductors of different American scientific works to which he sent his papers were compelled, at length, to refrain from giving publication to his frequent and voluminous contributions. Not even the German ornithologist, Brehm, went the length which M. Raffinesque ultimately did in regarding every trivial variation as indicative of specific distinctness. See a biographical memoir of M. Raffinesque in one of the American scientific periodicals (I do not now remember which), appended to the announcement of his demise.—E. B.

son's Bay Company ship their furs from their factory at York Fort, and from Moose River on Hudson's Bay; their collection from Grand River, &c., they ship for Canada; and *the collection from Columbia River goes to London.*" This wholesale destruction of the fur-bearing animals, and alleged destination of their spoils, seem hardly reconcilable with the opinion that any large species could still remain unknown to European naturalists; and if additional species of the present group existed, especially about the Columbia River, there is certainly no accounting for the total absence of their reliques from among the prodigious multitudes of Lynx skins, from nearly all parts of North America westward of the Rocky Mountains, which find their way to London, and have been diligently examined by myself and others in the store-rooms where (together with other kinds of peltry) they are exhibited previously to each half-yearly sale by the Hudson's Bay Company. From what enquiries I have been able to make of persons who have traversed the western territory of North America, the two well-known species already described appear to be generally recognised as the "Wild Cat" and the "Mountain Cat" or "Catamountain"; and to these, I think, most of the notices of authors may be satisfactorily referred, making some allowance for vagueness in descriptions from memory, or which, perhaps, in some instances, have been given at second-hand. In Brickell's 'History of Carolina' (A. D. 1737, p. 107), a rude figure is published of the "Mountain Cat," though, at the same time, the least bad one in the plate, representing a streaked animal, but which cannot be intended for the Bay Lynx, or common American "wild Cat," as this is separately described by him. It is possible, however, that the Arctic or mountain species is intended, having been designed, perhaps, from mere hear-say. Carver, also, in his Travels (p. 445), mentions the "Cat of the mountain," in addition to the "wild Cat," as being "much larger than a [domestic ?] Cat, with similar fur, but differing in colour, this being of a reddish or orange cast, becoming lighter on the belly. The whole skin is beautifully marked with black spots of different figures, of which those on the back are long, and those on the lower parts round. This creature is nearly as fierce as a Leopard, but will seldom attack a man." In this instance, I am of opinion that the term "wild Cat" refers to the Arctic Lynx, and "Cat of the mountain" to the Bay Lynx. Professor Nuttall, in his "Travels in the Arkansas Territory' (p. 118), notices "wild Cats

of two colours, both striped and spotted," but gives no further description; and Messrs. Lewis and Clarke assert, that—"The Tiger-cat inhabits the borders of the plains, and the woody country in the neighbourhood of the Pacific. It is of a size larger than the wild Cat [Bay Lynx] of the United States, and much the same in form, agility, and ferocity; but its hair is long and fine, far exceeding that of the animal mentioned. The colour of the back, neck, and sides, is of a reddish brown, irregularly varied with spots of dark brown, the tail is about two inches long, and nearly white, except the extremity, which is black: it terminates abruptly, as if it had been amputated. The belly is white, beautifully variegated with small black spots. The legs are of the same colour as the sides, and the back is marked transversely [!] with black stripes: the ears are black on the outer side, covered with fine short hair, except at the upper part, which is furnished with a pencil of hairs, fine, straight, and black, three-quarters of an inch long"*. To me this somewhat elaborate description appears very much as if it had been drawn up from recollection only, the tail being represented as but two inches long, and the back as *marked transversely*, which is at variance with every other species of Cat known. The country, too, where the animal is stated to inhabit, has now been pretty well examined, and is known to yield the Arctic species, which I cannot bring myself to doubt was that intended by the travellers. M. Raffinesque, however, who never allowed an opportunity to pass of coining a name, whether or not he had seen a specimen, or so much as a portion of one, or even a drawing that could be depended on, has imposed the name of *fasciata* upon the sole authority of Messrs. Lewis and Clarke's description. The same author has indicated, as the Golden Lynx (*Lynx auratus*, Raffinesque), an animal mentioned by Leray ('Voyage au Missouri,' p. 190), who met with it, according to Dr. Harlan, on the border of the Yellow-stone River, near the 44th degree of north latitude, and 32d of western longitude from the meridian of Washington. The animal is described as "one half larger than the domestic Cat, the tail two inches long, and ears penicillated; colour, a clear brilliant yellow, spotted with black and white". The reputed *Catamount* is M. Raffinesque's *Lynx montanus*, to which Dr. Harlan is disposed to refer the *Mississipi Lynx* of Buffon, which is clearly the Bay Lynx, and some-

* Narrative of Expedition, III, 28.

thing else is noticed by him as *Lynx Floridanus*. I have not been able to consult M. Raffinesque's paper on these animals, which was published in the 'American Monthly Magazine' for 1817, p. 46; and only know it from the references of Dr. Harlan and others. Should there really be any additional species to those admitted here, no doubt M. Audubon's forthcoming work on the Mammals of North America will include them; but I repeat the expression of my strong suspicion, that none of the foregoing indications will ever be confirmed.

With respect to the Lynxes of Scandivania, a notice occurs in Sir Arthur de Capel Broke's 'Travels in Sweden,' &c. (pp. 147 *et seq.*), which in parts is somewhat obscure. "The forests in the province of Drontheim," it is remarked, "abound with different species of wild animals, as Bears, Wolves, Lynxes, Foxes, Martens, Cats,* &c. The Lynx of the north is not rare in this part of Norway. In the Norwegian language it is called *Goupe*, and in the north of Sweden it is generally termed *Wargilue*. From the skins of this animal that were shewn to me in different parts of Norway and Lapland, three of which differed very materially in colour, it seems that there are, at least, as many species or varieties. Of one of these M. Knudtzon had several. The largest measured five feet in length, not including the tail, which did not exceed an inch and a half. The colour of them all was grey, with a yellowish tinge, beautifully marked with dark spots, and the ears were tufted. The general price they brought at Drontheim was about five specie dollars, or one pound sterling. This seems to be peculiar to Norway, as I never observed it during my subsequent travels. [It would appear to be *F. cervaria*, but much stretched, and the tail imperfect.] Of the two others, which I met with in Lapland and Sweden, one that I saw at Urnea measured, from the muzzle to the beginning of the tail, five feet eleven inches [!], and the tail was hardly two inches and a half. The appearance of the skin in every respect so much resembled that of the Leopard, that I should have suspected it to have belonged to that animal, had it not been for its tufted ears, and the length and superior thickness of the fur. [I presume this to have been an excessively stretched skin of *F. cervaria* killed in summer, when the pale tips to the fur had disappeared.] The third species, which I met with in Swedish Lapland,

* Vide Note to p. 24.

differed very materially from the other two, being of an uniform reddish-brown colour [summer aspect of *F. borealis*]. In length it exceeded five feet [!]. This, which I imagine to be the same as the North American Lynx, and the animal most commonly known by the term Lynx, I have seen alive in the collections of this country, though of a much smaller size." Sir Arthur proceeds to remark on the magnitude of the skins noticed; and if my presumed identifications of them are correct, he does not appear to have been acquainted with the ordinary species of the northern forests, or veritable *Warg-lo (Wargilue)* of the Swedes.

The Caracal (*F. Caracal*, Auct). This well-known species appears to bear that affinity to the Domestic Cat, which the preceding do to the European Wild Cat; and like its analogue, is distinguished by having a tapering tail, in addition to its facile capability for domestication: individuals, however, vary in this respect, as observable in all the higher animals. Length about two feet and a half, the tail nine or ten inches additional; ears three inches, or with tufts three-quarters of an inch more; and height of the back sixteen or eighteen inches. General colour bright fulvous-brown, silvered over with whitish tips in winter, and paler on the under-parts, with some spots generally obscure, but sometimes tolerably distinct, on the belly, flanks, and inside of limbs; ears black without, terminating below in a point considerably beyond the ear; no black spot on the border of the upper lip, but one where the moustaches grow, and another above each eye, and there is a line down each side of the nose; extreme tail-tip black.

This animal is common to all Africa, from Barbary to the Cape of Good Hope, where it is not unfrequent; also to a considerable portion of western and even central Asia, being termed *Tsogde* in Little Tibet, and *Ech* in Ladakh, as I was informed by Mr. Vigne, who shewed me an excellent drawing of a trained one he saw in the former country: but if it exist, according to the current statement, in India, it must be only or chiefly in the western parts, not improbably in the same districts as the Lion: for though its range is asserted in the *Dict. Class. d'Hist. Nat.* to extend from Barbary to Bengal, and Mr. Ogilby mentions it as met with in most parts of India,* while various other authorities

* 'Mammalogy of the Himalaya,' p. 10.

might be cited to the same effect, yet it is neither included in Col. Sykes's list of the Mammalia of the Deccan, nor in the elaborate Catalogue of those of the Southern Mahratta country by Mr. Elliot, neither can I learn of any trace of it in Bengal; Mr. Hodgson omits it in his list of Nepâlese Mammalia (*J. A. S.*, X, 908), and, proceeding eastward, Dr. Griffith among those of Assam. It is even likely that, like the Cherrug Falcon, trained individuals may be occasionally brought from beyond the Indus, and that such have erroneously induced the statement that they were indigenous to the provinces where seen. It is said to inhabit Arabia, as well as Persia, and it is not unfrequently designated the *Persian Lynx*, being trained, especially in that country, to creep and spring upon game, in the manner of the Cheetah. This animal is the *Karrah Kulak* of Persia, *Gat el Khalleh* of Barbary, and bears the name of *Seer-gosch* in India. M. Temminck states, that the wild Caracals hunt in packs of several individuals, pursuing and attacking game in the manner of wild Dogs; but this, I should say, much requires confirmation; as does particularly its claim to be considered as indigenous to India.*

There is a *Felis aurata*, Temminck, (not *Lynx auratus* of Raffinesque,) which appears to need further establishment as distinct from the Caracal. It is described as rather smaller than that species, with tail half the length of the body, a brown band along the median line of the tail, but the extreme point black. Ears short, rounded, not penicillated; the coat very short and lustrous. All the upper-parts are very bright rufous-bay and spotless, with indistinct streaks of a somewhat deeper tint on the flanks; lower parts reddish-white, marked with large and small spots of maronne-brown; ears perfectly black without, and reddish within; limbs golden. Length three feet four inches, of which the tail is twelve inches and a quarter. Described from a skin purchased in London, locality unknown.

* Since writing the above, I have been assured of one having been killed near Jubulpore, in central India.—E B.

Selections communicated by the Suddur Board of Revenue at Allahabad, from Correspondence respecting the proposed formation of a Canal for Irrigation to be supplied from the River Jumna, near the Village of Kuttha Putthur, in the Deyra Doon. From Captain P. T. Cautley, *to the Secretary of the Suddur Board of Revenue, North Western Provinces, Dooab Canal Office, Camp Hurdwar, 29th April,* 1841.

Sir,—In the Revenue Survey of the Deyra Doon completed by Captain Brown, that officer notes " that the lands north of the Sutwala Row in general, may be irrigated from the Jumna, by a Canal cut from Domayut, but the excavations would be expensive."

2. During the late cold season, I took the opportunity of examining the country, which would be benefited by such a work as Capt. Brown refers to, and as I was on the spot, this examination naturally led to a further inquiry into the practicability or not of getting water out of the Jumna upon the high land; the results, which for the satisfaction of Government I have put into form, will be found in the sheet of Plans and Sections which accompany this letter, fig. 1, being a map on a scale of four inches to a mile of the ground over which the Canal will take its course; fig. 2, a map on a quarter of the scale, of the country bounded on the north by the hills and forests of Umbarree and Puthipoor; south by the Asun river; east by the Sutwala Row; and west by the Jumna river. The rest of the figures are longitudinal and cross sections, with plans, &c. of works in masonry which will be required to maintain a regular flow of water.

3. In fig. 2, the course of the Canal is indicated by a blue dotted line, and it will be observed, that as the mountain drainage crosses it at right angles at two points, the whole tract to be irrigated is divided into three distinct portions, stretching from the Canal to the Asun river, the slope of country being in every way favourable to the irrigator.

4. The return of village lands which accompanies this letter shews, that about 17,000 acres of cultivable land will be benefited by this Canal; the country is open with little forest, and only requires a Canal to bring it under cultivation. The want of water* at present prevents the

* Captain Cautley in a subsequent letter explains, that he here alludes to *drinking* water; and adds,

establishment of villages at a distance from the Asun and Jumna rivers, and the want of population depending on this circumstance will, I imagine, until a Canal is made, interfere altogether with the improvement of this portion of the Doon.

5. The amount of my estimate (Rs. 90,307 : 0 : 0) which depends entirely on the difficulties of the first three and a half miles of the course of the Canal is high, but the return of water, rent, mills, etc. when the water-course is doing its proper work, would render such an outlay admissible.

Thus :—

	Rs.	*As.*	*Pie.*
17,000 Acres, or 27,200 Puk. Begas, @ 5 annas per Bega, ...	8500	0	0
Mills, corn, sugar, sawing, etc.	1500	0	0
Total,	10,000	0	0
Deduct Repairs and Establishment.	3000	0	0
Balance net profit, ...	7000	0	0

or equal to $7\frac{3}{4}$ per cent.

6. For a detail of the work I must refer you to figs. 1, 4, 5, 6, 7, 8, 9, 10, the latter being the longitudinal section, the capital letters noted on each referring to particular points; the position, elevation, or depression of which will be easily recognized.

7. It was found impracticable to establish a head at Domayut, the steppes into to the river from the high land being not only exceedingly high, but the relative level of the Jumna's water being low, full advantage was not attainable so far down the river; the head which I have established is immediately under the village of Kuttha Puttha, and at the highest point that the mountains would admit of; the head is favorably situated for a supply of water, and as the depth of digging at that

"In a note from the manager of the Hopeton Grant, dated 25th inst. he observes with reference to the land which would be benefited by the Kuthur Puthur Canal, 'the whole of the lands which you noted as to be commanded by his Canal are still lying waste. Some attempts that I made to cultivate in the outskirts are likely to prove abortive, for the Prithipoor well is almost dry, and the people in that neighbourhood have to drive their cattle to the Jumna for water; they cannot stand out against want of water.' This is characteristic of all the tract coming under the influence of the proposed Canal; the Puthipoor well is, I believe, the only one in existence in its neighbourhood. Water therefore is not only necessary for irrigation, but for the common purposes of life, and consequently, for the concentration of people for agricultural purposes."—*Vide his letter of 26th May*, 1842.

point will be thirty-six inches, the expenses necessary for spurs and bunds will be trifling.

8. From the head to a point at a distance of 4,755 feet, the course of the canal is passed by two rows or mountain streams, one of minor importance having a dam with two openings of ten feet each, the other with a dam of ten openings, as represented at fig. 13. The quantity of boulders, or river stone, in this part of the country will render the execution not only easy, but will enable them to be completed at a very moderate expense. These dams will be precisely the same as those in use of the Doab Canal, with sleeper planks, etc. etc.

9. The second division of the work may be considered as that from the letters A to N, or 18,916 feet; on this line the course of the Canal creeps along the slopes and scarps of the high banks, descending to the Jumna; and the level of the Canal bed, which is proposed to be twenty-four inches per mile, strikes out on the surface of the country at the latter figure. Four mountain streams will be passed by aqueducts, two of them having a span of fifty-one, of forty-five, and the other of twenty-five feet. Care and attention is all that is required to surmount the difficulties of excavation on this line; neither the original labor, nor the chance of after-accident is equal to that which I anticipated on the first mile of the Beejapoor water-course. The soil is full of large shingle or boulders, and the excavation which has been estimated for, is ample to render the work fully efficient. Portions of the line where the Canal comes in contact with high banks is proposed to be constructed of masonry, as represented on the section in fig. 15. The masonry channel will lead to and from the masonry aqueducts, as well as from the dam of ten openings, which I have described as constituting part of the work of the first division, and immediately south of this dam, grooves for sleeper planks will be made in the main channel, so as to keep it clear of water during floods. As the breadth of main channel and that of dam-openings correspond, the same sized plank will do for both.

10. The third division, from the letter N to the Seetla or Sutwala Row, or a distance of 21,834 feet, is plain digging. Six lines of drainage are crossed: two by aqueducts of twenty-five feet span each; four by dam or outlet, one of which has ten openings of ten feet each; and three outlets of ten feet each. The slope of the Canal bed is still continued on a descent of twenty-four inches per mile. The extra

slope being overcome by four falls in masonry: one of four and half feet, two of eight feet, and one of twelve feet, which latter will deliver the tail-water into the Sutwala Row, and ultimately into the Asun and Jumna rivers.

11. The facility with which boulders will be procured, and the cheapness of the very best lime, ought, I should think, to enable the persons, who superintend the construction of these works, to do them efficiently on the estimate now submitted.

12. I need hardly advert to the power for machinery which is introduced into the Doon by the construction of these masonry falls. On the Beejapoor water-course, there are 115 descents averaging four feet each. On the Kuttha Puttha Canal, the four proposed falls will place on the high lands means for machinery of every description. It may be long before these means are taken advantage of, but with the growing interest taken in this valley, the annual arrival of new settlers, the certainty that a new generation of Europeans is now springing up, who must look to a livelihood from this country, I see in perspective not only a valley rich in its fields and harvests, but one that will be the centre of an active and manufacturing population.

13. The quantity of water required by the Kuttha Puttha Canal is eighty cubic feet a second. When not used for irrigation, the escape ultimately finds its way back to the Jumna, through the course of the Sutwala and Asun rivers.

14. I am prepared for a question that may be put as to the propriety of going to the expense of this work for using, (advantageously though it may be,) eighty cubic feet of water, when the demand for the Delhi and Doab Canals absorbs during years of drought the whole volume of the Jumna river, and when this eighty feet, now proposed to be turned to account in the Doon, at an expense of 90,000 rupees, would be used in the Doab without incurring any expense at all. In the right that Government has very properly assumed over the waters in the Doon, I merely see the intention of regulating the supply and establishing a supervision, so that the water taken from any river may be applied to the greatest advantage. The inhabitants of the Deyra Doon, who on the west side possess the Asun river rising in their own country, and pouring a supply of water into the Jumna, equal to 600 cubic feet a second, may well be permitted to relieve the Jumna of one-eighth of that

amount; their claim to such a small proportion is infinitely greater than that of others, and as the necessity for water not only for irrigation, but even for drinking, is as great on this tract of the Doon as it is on any portion of the districts under the influence of the Delhi and Doab Canals, this claim to a portion of the Jumna may be fairly conceded.

15. In the case of the Beejapoor water-course, which was proposed to be opened by a private individual, a precedent, and a very judicious one, appears to have been established of preventing a work of this nature, which must ultimately be of service to all, from becoming the private property of one person. Government in the case alluded to, proposed being at the expense of the work, so as to admit of the benefits being equally distributed, both amongst the Native and European farmers. The same argument would apply to the Kuttha Puttha Canal; the expenses of outlay on this work, however, are beyond the means of the holders of the land coming under its influence. This fine tract of cultivable land, therefore, must lie waste unless Government gives its aid in the first instance. I believe, that I have shewn that there are no natural obstacles to the undertaking, and should the return for outlay come up to the estimate which I have made of it, the sanction to carrying the work into effect would, in giving fair interest for the capital expended, be the means of fertilizing a large tract of the valley which otherwise must lie waste and uncultivated.

I have the honour to be, &c.

(*Signed*) P. T. Cautley, *Capt.*
Superintendent Doab Canal.

To H. M. Elliott, Esq.
Secretary, Revenue Board, Allahabad.

No. 38.

Estimate for the Kuttha Puttha Canal in the Deyra Doon, for the Irrigation of the tract of Country bounded by the Jumna, Asun, and Seetla Rivers, Doab Canal Office, 14th April, 1841.

Description,	Measurement. L.	B.	D.	No.	Cc. ft.	Total Cc. ft.
Kuttha Puttha Dam No. 1.						
Floorings, ...	29	area	114	× 1	= 3306	
Piers, centre and side, ..	3	area	66	× 3	= 594	
Tail Wing Walls, ...	25	× 3	× 5	× 2	= 750	
Front ditto, ...	7 ×	area	48	× 2	= 672	
Total Cubic feet,..	..	..	..	..	..	5322
Domayut Row Drainage No. 2.						
Floorings, ...	147	area	114	× 1	= 16758	
Piers, centre and side, ..	3	×	66	×11	= 2178	
Tail Wings, ...	25	× 3	× 5	× 2	= 750	
Front ditto, ...	7	area	48	× 2	= 672	
Total Cubic feet,..	..	..	..	..	..	20358
Aqueduct No. 3 *Nulla.*						
Piers, ...	16	× 10	× 17	× 2	= 5440	
Arch, ...	16	× 60	× $3\frac{1}{2}$	× 1	= 3360	
Wing Walls, ...	40	× 3	× 10	× 4	= 4800	
Flooring, ...	150	× 3	× 16	× 1	= 7200	
Parapets, ...	150	× 3	× 4	× 2	= 3600	
Cordon, ...	150	× $1\frac{1}{4}$	× 1	× 2	= 375	
Abutments to Piers, ...	10	× 1	× 30	× 4	= 1200	
Total Cubic feet,..	..	..	..	..	..	25975
Aqueduct No. 4.						
Nulla same as above,	..	..	..	..	..	25975
Aqueduct No. 5 *Nulla.*						
Piers, ...	16	× 8	× 13	× 2	= 3328	
Arch, ...	16	× 52	× 3	× 1	= 2496	
Wing Walls, ...	35	× 3	× 10	× 4	= 4200	
Flooring, ...	130	× 3	× 16	× 1	= 6240	
Parapets, ...	130	× 3	× 4	× 2	= 2120	
Cordon, ...	130	× $1\frac{1}{4}$	× 1	× 2	= 325	
Abutments to Piers, ...	8	× 1	× 24	× 4	= 768	
Total Cubic feet,..	..	..	..	..	..	20477
Carried over Total Cubic. feet.	..	..	..	..	.. ..	98107

Description.	Measurement. L.	B.	D.	No.	Cc. ft.	Total Cc. ft.
Brought over Cubic feet..	..	..	..	..	..	98107
Aqueduct No. 6 Nulla.						
Piers, ...	16	× 6	× 13	× 2	= 2496	
Arch, ...	16	× 30	× 3	× 1	= 1440	
Wing Walls, ...	22	× 3	× 6	× 4	= 1584	
Floorings, ...	80	× 3	× 16	× 1	= 3840	
Parapets, ...	80	× 3	× 4	× 2	= 1920	
Cordon, ...	80	× 1¼	× 1	× 2	= 200	
Abutments, ...	6	× 1	× 24	× 4	= 576	
Total Cubic feet, ..	..	..	..	..	..	12056
Aqueduct No. 7, same as above,	..	..	..	..	..	122219
Outlet No. 8 Drainage.						
Floorings, ...	16	area	114	× 1	= 1824	
Piers, ...	3	area	66	× 2	= 396	
Tail Wing Walls, ...	25	× 3	× 5	× 2	= 750	
Front ditto, ...	7	area	48	× 2	= 672	
Total Cubic feet, ..	..	..	..	..	..	3642
Outlet No. 9 Drainage, same as above, ...	..	..	..	..	..	3642
Aqueduct No. 10, same as at No. 4, ...	..	..	..	..	..	12056
Dam No. 11, same as Domayut Row Drainage, .	..	..	..	..	..	20358
Outlet No. 12 Drainage, same as No. 6, ...	..	..	..	..	..	3642
Masonry Water Channel Area Section 26 × 10560	..	..	..	..	..	274560
Total Cubic feet of Masonry,	..	..	..	..	..	440119

Earth Work.

On the first 23,671 feet in length the Canal either crosses the Steppes or traverses the Bank, dipping into the valley of the Jumna. The superficial soil is clay and sand, that under it shingle; where the Canal traverses the Banks, the excavation will be done without Cooli labor, by throwing the shingle and earth over the sides.

1st Portion,	7431	× 15	× 20	..	..	2229300
2d Portion,	16240	× 25	× 20	..	..	8120000
3d Portion,	21834	× 20	× 6	..	..	2620080
				Total Excavation, ..		12969380

Masonry 440119 *Cubic feet.*

Of which	40,119 Cubic feet, @ 16 Rs. per 100, ..	6419	0	7
,,	100,000 ditto, @ 12 Rs. per 100, ..	12000	0	0
,,	300,000 ditto, @ 8 Rs. per 100, ..	24000	0	0

Earth Work 12969380 *Cubic feet.*

Of which	10,349,300 Cubic feet, @ 3 Rs. per 1000, ..	31047	14	5
,,	2,620,080 ditto, @ $2\frac{1}{2}$ Rs. per 1000, ..	6550	3	2
4 Falls with Bridges attached, 150 Rs. each, ...		600	0	0
2 Bridges Villages, @ 60 Rs. each, ...		180	0	0
2 Mills, @ 500 Rs. each, ...		1000	0	0
100 Planks for Dams $10\frac{1}{2}$ feet × 1 feet × $2\frac{1}{2}$ inch with iron straps, &c. complete, @ 3 Rs. each, ...		300	0	0
	Total Co's. Rs. ..	82097	2	2
Add for Contingencies, ...		2809	13	10
	Grand Total, Co's. Rs. ..	90307	0	0

Assignment required on the Saharunpoor Treasury.

(*Signed*) P. T. Cautley,
Superintendent, Doab Canal.

KUTTA PUTTHUR CANAL
DEYRA DHOON

Return of Village Lands in the Deyra Doon, which will come under the influence of the Kuttha Puttha Canal, extracted from Captain Brown's Revenue Survey, Doab Canal Office, 14th April, 1841.

Names of Villages.	Cultivation including fallow.	Lately thrown out of Cultivation.	Fit for Cultivation and capable of immediate return.	Fit for Cultivation not capable of immediate return.	Barren Sub-forest Ravines.	Barren Waste, &c.	Barren ½ of amount of Waste, fit for Cultivation.	Khyr Forest.	Barren Waste including 22 Acres of Bit Jungle.	Total Acres.	Captain Brown's Remarks.
Hopeton, ...	180	31	4,396	729	439	411	1,708	..	..	7,894	It appears that the lands North of the Sutwala Row in general, may be irrigated from the Jumna by a Canal cut from Domayut.
Annesphail, ...	689	..	4,319	21	..	..	1,479	95	859	7,462	The Khadir lands can be irrigated from the Jumna, and amount to 1,610 Acres: it also appears to be practicable to irrigate the higher lands from the Jumna, but the excavation would be expensive.
Dhukrani, ...	461	72	1,252	..	..	695	..	..	..	2,480	
Mundi, ...	..	..	71	..	..	49	..	..	..	120	
Rajghat Mundi, ...	5	11	284	..	..	164	..	..	..	464	Ditto.
Lakhunwala, ...	259	3	175	..	..	95	..	..	..	532	Ditto.
Futehpoor, ...	314	10	346	..	..	259	..	..	..	929	Ditto.
Byragewala, ...	55	..	85	..	..	47	..	..	..	187	Ditto.
Jusoowala, ...	..	..	..	..	..	..	..	..	..	..	,,
Pirtheepoor, ...	78	..	14	..	..	14	..	..	..	106	Ditto.
Gungbewa, ...	57	..	11	..	..	12	..	..	..	80	Ditto.
Grand Total, ...	2,098	127	10,953	750	439	1,746	3,187	95	859	20,254	

I have not been able to procure the return on the Village of Jusoowala, but as the above contains the whole area of the Hopeton West Grant, portion of which is on the East side of the Seetla, or Sutwala Row, the admission of the one will more than cancel the omission of the other. By this there appear to be 17,115 acres of land which may be cultivated, omitting the items in the 5th, 6th, 7th, and 8th columns, the greater portion of which would also become cultivable land.

(Signed) P. T. Cautley, *Captain, Superintendent Doab Canal.*

No. 33.

To G. F. Franco, Esq.

Commissioner, Division of Meerut.

Sir,—I have the honour to acknowledge the receipt of your letter, No. 35, dated 12th July 1841, with its enclosure, and map as per margin,* relative to a Canal proposed to be cut from the river Jumna at Kutta puther, for the purpose of supplying water for drinking and irrigation to a portion of the Dhoon, where it is indispensibly required to secure the settlement of villages, increase of population, and cultivation of some of the finest and richest lands in the western division of the Dhoon, and calling on me for a report on the same.

* Capt. Cautley's letter No. 1883, dated Doab Canal Office, Camp Hurdwar, 29th April 1841.
Estimate No. 38 dated the same office, 14th April 1841.
Return of Village Lands, extracted from Capt. Brown's Survey, dated the same date.

The delay which has occurred in sending my reply, was caused by the uncertainty which existed regarding the quantity of water which would be contracted for by Grantees and Mookuddums falling under its influence, in consequence of the principal grant being in progress of transfer; this arrangement having been brought to a satisfactory conclusion, and the present holders having the means at command of carrying into full effect the intentions of Government in opening the Canal, I have much pleasure in reporting, that I have consulted the wishes of all those whose lands come under the influence of the Canal under consideration, and the desire to have it completed, as soon as possible, is universal, and all are ready to engage for as much water as will irrigate all the lands falling under its influence, which after examination and comparing with Captain Brown's survey, does not appear to be overestimated by Captain Cautley when he reports it to comprise 10,700 acres. A great portion of this land is now waste, overgrown with fine grass, and uninhabited, principally from want of water; these obstacles being removed, there is not a doubt, but villages will spring up and the population will increase.

The full amount of the receipts calculated on by Captain Cautley, may not be realized the first or second year, but they will increase, and lands at present waste will soon become productive, and ultimately yield a considerable revenue to Government, which has not

been taken into consideration in Captain Cautley's estimate. Under this impression, I cannot too strongly urge my recommendation of the undertaking being commenced on as soon as circumstances will permit. I have detained the documents stated in the margin, for the purpose of taking a copy of them for registry in my office; when that has been effected, I shall have the honour of returning them.

I have the honor, &c.

(Signed) F. Young, *Lieut. Col.*
Political Agent.

Deyrah Dhoon,
Political Agent's Office,
the 30th October, 1841.

The Commissioner of the Meerut Division, in submitting the Political Agent's report, with his letter No. 433 of the 24th December 1841, observes, Par. 2: "I consider that one lac of Rupees would "be well laid out in the construction of this work, and that it would "yield a sure and early return. The grantees in the Doon are en- "terprising, and will avail themselves immediately of the means of "irrigation afforded, by bringing under tillage the arable land now "lying waste for want of water. Colonel Young's reference to those "who would benefit by the proposed Canal is very satisfactory, and "I know that the grantees are most desirous that the work should be "undertaken."

No. 118.

Canal Office, West of the Jumna, Kurnaul, July 7, 1841.

To H. M. Elliott, Esq.
Secretary, Sudder Board of Revenue,
Allahabad.

Sir,—I have the honor to acknowledge the receipt of your letter No. 63 of the 22nd ultimo, enclosing copy of Captain Cautley's report on a proposed water-course from the Jumna in the Deyra Dhoon, on which you do me the favor to ask my opinion.

2. The simplicity of the work proposed, and the known skill and experience of Captain Cautley, leaving no doubt as to the correctness of the estimates, the practicability of the work, or its exact suitable-

ness to the purposes for which it is intended, I suppose that my opinion is merely required on the question mooted in the 14th paragraph of Captain Cautley's report, regarding the expediency of diverting any part of the Jumna water from the supply of the existing Canals.

3. The supply of water in the Dehli Canal has during some months of three several years; (viz. 1836-37, 1837-38, and 1840-41,) fallen considerably short of the demand, and many villages situated near the ends of the Canal branches in the Dehli, Rohtuk, and Hansie districts, have, from this cause, and from the greater consumption of water by those above them, been temporarily deprived of the full means of irrigation they once possessed, nor has the loss been confined to the villages so situated, as it has necessitated vexatious restrictions on the irrigation throughout the whole line of Canals.

4. Under these circumstances, I consider it my duty (both to Government, whose revenue settlements have been made with reference to present means of irrigation, and to the Zemindars, whom I have induced and assisted to dig water-courses,) to deprecate any avoidable diminution of the Jumna water.

5. I am willing to admit that the Doon may probably benefit more from the Kutha Puttur Canal, than the Dehli territory would lose by the abstraction of eighty cubic feet of water per second, and that the whole of the eighty feet so abstracted might not be a dead loss, as some surplus might return via the Satwala and Asun to the Jumna, and a proportion even of that used in irrigation, might, by percolation of the soil, find its way into the natural drains of the country, and eventually return to the parent stream. A deduction may also be claimed for waste by absorption and evaporation, during the transit of the said eighty feet from the Dhoon to the irrigating districts of the Dehli territory. But with respect to the first concession, I submit that the Dehli territory has a prescriptive right to as much of its present means of irrigation as can be maintained, and though I cannot exactly estimate the effects of the latter, I believe that they would be found inconsiderable, and at all events, it is undeniable that some loss would occur, and whether that loss be small or great, the principle remains unaltered.

6. It may be argued, that the loss of the Dehli territory merely results in that of Government, who have the power of compensation by re-

mission of revenue, and that the real question, therefore is, whether the moral and political advantages anticipated from the colonization of the Dhoon are likely to overbalance the partial deterioration of the Dehli territory as a source of revenue, and the proportionate loss of the original outlay on the Dehli Canal. But I consider that the discussion of such questions will not be expected from me, who am merely called upon to state *(ex parte)* in what degree the contemplated measure would affect the particular interests intrusted to me by Government.

7. In conclusion, I beg to acknowledge the courtesy of the Sudder Board of Revenue, in having allowed me an opportunity of bringing forward the above statement.

And have the honor, &c.

(Signed) W. E. Baker,
Superintendent of Canals, West of India.

Extract Pars. 2 to 4 of letter No. 2603, dated 8th February 1842, from Captain F. Abbott, Officiating Superintending Engineer, North-west Provinces.

2. "I much regret that I did not receive the plans of the Kutha Puther water-course, as I could not in consequence, examine the proposed site. I have, however, been over portion of the ground to be watered by this project, and have visited the Jumna, near the proposed head.

3. "Captain P. T. Cautley proposes, I believe, to draw off seventy-five cubic feet per second from the Jumna, for the supply of the Kutha Puther water-course. Of this a portion would return to the Jumna in the shape of tail-water, and a small portion by percolation. I am therefore of opinion, that the diminution of the river's volume, at the heads of the Doab and Dehli Canals, would be imperceptible. It must, however, be noticed, that the whole loss, instead of being divided between the two, would fall exclusively upon the latter, as the Doab Canal has the command of head.

4. "It would appear adviseable, on general principles, to make this small sacrifice upon the Dehli Canals, with the view of fertilizing so large a portion of valuable land as that contemplated by the Kutha Puther project, amounting I believe to 26,000 Beeghas, were measures

taken to ensure the use of its waters; and I think this might be effected by the adoption of the assessment or contract system. But some agreement should, I think, be entered into with the landed proprietors previous to commencing upon the work, to save the State from chance of loss."

No. 160.

To R. N. C. Hamilton, Esq.

Secretary to Government, N. W. Provinces, Agra.

Sir,—In submitting for the consideration and orders of Government, the accompanying correspondence respecting the opening of a new Canal near the village of Kutha Puther, in the Dehra Doon, the Sudder Board of Revenue, N. W. P. observe, that Captain Cautley estimates the expense of the proposed water-course to be, 90,307, and that it will yield 7,000 Rs. per annum, or about $7\frac{3}{4}$ per cent. the capital sunk.

2d. At the same time it will divert from the channel of the Jumna 75 cubic feet of water per second, of which one-half, it is calculated, will be entirely lost to the volume of the stream at the Doab Canal head. The whole of this water will be abstracted from the Dehli and not from the Doab Canal, the head of the former lying below that of the latter, and the loss will be felt during that portion of the year, when the whole body of the river is used for irrigation through the Canals.

3d. Half the water then which will yield rent through the Kutha Puthur water-course, after an outlay of 90,000 Rupees, would at present yield a higher rate through the Dehli Canal, without any outlay at all.

4th. Hence it seems very questionable whether, viewing the question as a mere profit on the consumption of a certain quantity of water, it would be desirable for the Government to engage in this undertaking.

5th. There are, however, many other questions which might influence the decision, and on these the Board have not the means of decidedly expressing an opinion at present. The Dhoon may perhaps become a most valuable portion of British territory, from the peculiar adaptation of its soil to the more valuable products, and from the fitness of its locality and climate for the enterprize of British capitalists.

Without artificial irrigation of this nature, large tracts of it, and amongst them that which would come under the influence of the Kutha Puthur Canal, cannot be brought under cultivation. Wells cannot be dug, and the difficulty of procuring water even for domestic purposes, renders them uninhabitable. The water in such cases possesses a double value, being used for the support of life, as well as for irrigation, whilst the rapid fall of its course gives it a still further value as the motive power of machinery.

6. It is therefore far from improbable, that other circumstances besides those of a mere profitable return for the water may render the execution of the proposed work deserving the attention of Government, or become an object for private enterprize.

7. Agricultural operations in the Dhoon are still too much in their infancy to enable the Board to speak with confidence on these points, whilst they are also unprovided with results from the experience of the lately opened Beejapore water-course, and the now constructing Rajpore water-course, on which to build any certain calculations of the effects of such works in the peculiar climate and soil of the Dhoon.

8th. The present time is also probably one in which the Government would be reluctant to engage in an expensive undertaking of problematical utility.

9th. These considerations restrain the Board from recommending the work for immediate execution. But they think it of great importance that the scheme should be generally made known, in order that its merits may be fully discussed. They therefore propose, with the sanction of the Government, to print the Plans, and so much of the Correspondence as may tend to throw light on the project, and hope on some future opportunity to be able to bring the subject again forward on better grounds than they at present possess.

I have the honor, &c.

(*Signed*) H. M. Elliott, *Secretary.*

Sudder Board of Revenue,

N. W. P. Allahabad, the 1*st April,* 1842.

(True Copies.)

H. M. Elliott, *Secretary.*

Comparison of the Areas of Plane and Spherical Triangles. *By Captain* SHORTREDE, *1st Assistant, Grand Trigonometrical Survey.*

[N. B.—The first part of the following investigation is taken from Young's Trigonometry, but the formula there deduced $\cot \frac{1}{2} E = \left\{ \frac{\cot \frac{1}{2} a \cot \frac{1}{2} b}{\cos C} + 1 \right\} \cot C$, being inconvenient in all cases, and utterly unworkable when $C = 90°$, I have transformed it as follows.]

E being the spherical excess

$$\tan \tfrac{1}{2} E = \tan \tfrac{1}{2} (A + B + C - 180°) = - \cot \tfrac{1}{2} (A + B + C)$$
$$= \frac{\tan \frac{1}{2} C - \cot \frac{1}{2} (A + B)}{1 + \tan \frac{1}{2} C \cot \frac{1}{2} (A + B)}$$

By Napier's analogies, $\cot \frac{1}{2} (A + B) = \frac{\cos \frac{1}{2} (a + b)}{\cos \frac{1}{2} (a - b)} \tan \frac{1}{2} C$

which substituted gives

$$\tan \tfrac{1}{2} E = \frac{\tan \frac{1}{2} C - \frac{\cos \frac{1}{2} (a + b)}{\cos \frac{1}{2} a - b} \tan \frac{1}{2} C}{1 + \frac{\cos \frac{1}{2} (a + b)}{\cos \frac{1}{2} a - b} \tan^2 \tfrac{1}{2} C}$$
$$= \frac{\left\{ \cos \frac{1}{2} (a - b) - \cos \frac{1}{2} (a + b) \right\} \tan \frac{1}{2} C}{\cos \frac{1}{2} (a - b) + \cos \frac{1}{2} (a + b) \tan^2 \frac{1}{2} C}$$
$$= \frac{\cos \frac{1}{2} (a - b) - \cos \frac{1}{2} (a + b)}{\cos \frac{1}{2} (a - b) \cot \frac{1}{2} C + \cos \frac{1}{2} (a + b) \tan \frac{1}{2} C}$$

Multiplying the numerator by sin C, and the denominator by its equal $2 \sin \frac{1}{2} C \cos \frac{1}{2} C$, we have

$$\tan \tfrac{1}{2} E = \frac{\cos \frac{1}{2} \left\{ \cos \frac{1}{2} (a - b) - \cos \frac{1}{2} (a + b) \right\} \sin C}{2 \cos \frac{1}{2} (a - b) \cos^2 \frac{1}{2} C + 2 \cos \frac{1}{2} (a + b) \sin^2 \frac{1}{2} C}$$

and substituting for $\cos \frac{1}{2} (a - b)$ and $\cos \frac{1}{2} (a + b)$, it becomes

$$\tan \tfrac{1}{2} E = \frac{\sin \frac{1}{2} a \sin \frac{1}{2} b \sin C}{\cos \frac{1}{2} a \cos \frac{1}{2} b + \sin \frac{1}{2} a \sin \frac{1}{2} b (\cos^2 \frac{1}{2} C - \sin^2 \frac{1}{2} C)}$$

and, because $\cos^2 \frac{1}{2} C - \sin^2 \frac{1}{2} = \cos C$,

$$\tan \tfrac{1}{2} E = \frac{\tan \frac{1}{2} a \tan \frac{1}{2} b \sin C}{1 + \tan \frac{1}{2} a \tan \frac{1}{2} b \cos C}.$$

This expression has some analogy to that for the area of a plane triangle, but here, unlike the case of the plane triangle, it is not a matter of indifference whether the contained angle be acute or obtuse. The second term in the denominator is + or — according as C $\lessgtr$ 90 or C $\gtrless$ 90. Hence the area and excess also of a spherical triangle whose

sides are given, is greater or less according as the contained angle is greater or less than 90.

When C = 90 the equation becomes simply

$$\tan \tfrac{1}{2} E = \tan \tfrac{1}{2} a \tan \tfrac{1}{2} b ;$$

and as every spherical triangle by letting fall a perpendicular becomes the sum or difference of two right angled triangles, this expression may be extensively used.

When the second term in the denominator becomes = 1, $\tan \frac{1}{2} E = \infty$, whence $\frac{1}{2} E = 90°$ and $E = 180°$.

When the second term exceeds unity, the whole expression becomes —, hence $\frac{1}{2} E$ is in the second quadrant, and the excess exceeds 180°.

In order to apply the expression above found to the comparison of the area of the spherical with that of a plane triangle, it may be otherwise written

$$\tan \tfrac{1}{2} E = \tan \tfrac{1}{2} a \tan \tfrac{1}{2} b \sin C \left(\frac{1}{1 - \tan \frac{1}{2} a \tan \frac{1}{2} b \cos C} \right)$$

when the denominator of the term within the parenthesis may be expanded in the usual way.

For $\tan \frac{1}{2} a$ and $\tan \frac{1}{2} b$ substitute their values in arc to radius 1 by the formula

$$\tan \chi = \chi + \tfrac{1}{3} \chi^3 \frac{2}{15} \chi^5 + \frac{17}{315} \chi^7 + \&c.$$

and we have $\tan \frac{1}{2} a \tan \frac{1}{2} b =$

$$\left(\frac{a}{2} + \frac{a^3}{24} + \frac{a^5}{240} + \frac{17\, a^7}{39720} + \&c. \right) \left(\frac{b}{2} + \frac{b^3}{3} + \frac{b^5}{240} + \frac{17\, b^7}{39720} \right)$$

which by actual multiplication becomes

$$\frac{ab}{4} \left\{ 1 + \frac{a^2 + b^2}{12} + \frac{6\, a^4 + 5\, a^2\, b^2 + 6\, b_4}{720} + \frac{136\, a^6 + 63\, a^4\, b^2 + 63\, a^2\, b^4 + 136\, b^6}{40320} + \&c. \right\}$$

This expression and its powers being substituted in the expansion of the original equations gives

$$\tan \frac{E}{2} = \frac{ab}{4} \sin C \left\{ 1 + \frac{a^2 + b^2}{12} + \frac{6a^4 + 5a^2\, b^2 + 6b^4}{720} + \&c. \right\}$$

$$\left\{ 1 - \frac{ab}{4} \cos C \left(1 + \frac{a^2 + b^2}{12} + \&c. \right) + \frac{a^2\, b^2}{16} \cos^2 C \left(1 + \frac{a^2 + b^2}{6} + \&c. \right) \right.$$

$$\left. - \frac{a^3\, b^3}{64} \cos^3 C \left(1 + \&c. \right) + \&c. \right\}$$

by actual multiplication and reduction of terms with common factors this becomes

$$\tan\frac{E}{2} = \frac{ab}{4}\sin C\left\{1 + \frac{a^2+b^2}{12} - \frac{ab}{4}\cos C + \frac{6a^4+5a^2b^2+6b^4}{720} - \frac{a^3b+ab^3}{24}\cos C + \frac{a^2b^2}{16}\cos^2 C + \&c.\right\}$$

For $\tan\frac{E}{2}$ substitute its value in arc $\frac{E}{2} + \frac{E^3}{24} + \&c.$ and transpose all the terms after the first, then substituting for them their values in powers of the quantity on the right hand side, we shall have

$$\frac{E^3}{24} = \frac{1}{3}\left(\frac{ab}{4}\right)^3 \sin^3 C + \&c. = \frac{ab}{4}\sin C\left(\frac{a^2b^2}{48} - \frac{a^2b^2}{48}\cos^2 C + \&c.\right)$$

incorporating these terms, and multiplying the whole by 2, we have

$$E = \frac{ab}{2}\sin C\left\{1 + \frac{a^2+b^2}{12} - \frac{ab}{4}\cos C + \frac{3a^4-5a^2b^2+3b^4}{360} - \frac{a^3b+ab^3}{24}\cos C + \frac{a^2b^2}{12}\cos^2 C + \&c.\right\}$$

The first term is the same as that for the area of a plane triangle having the same sides and contained angle: the following terms therefore shew the difference between the areas of the two triangles. Of these, we may take account of as many as suits our object; but in ordinary cases it will be needless to regard any beyond the two first. Limiting ourselves to these, the difference between the areas of the plane and spherical triangles corresponds to an excess represented by

$$\frac{ab}{2}\sin C\left(\frac{a^2+b^2}{12} - \frac{ab}{4}\cos C\right) \text{ or by } \frac{ab}{24}\sin C\left(a^2+b^2-3ab\cos C\right)$$

This expression shews that when cos C becomes —, or when C exceeds a right angle, the spherical area must exceed that of the plane triangle. When the two terms within the brackets cancel each other, the two triangles will have equal areas; and when the second term exceeds the first, the spherical area will be less than that of the plane triangle.

The limits are easily assigned.

The sum of a and b being given, $a^2 + b^2$ is a minimum, and $3ab$ is a maximum when $a = b$. In this case the triangles are isosceles, and $a^2 + b^2 = 2a^2$, and $3ab = 3a^2$; hence the terms within the brackets will cancel each other when $\cos C = \frac{2}{3}$ or when $C = 48° 11' 23''$. For equal areas this is the maximum of C. With isosceles triangles, if

C be less than this, the spherical area will be less than that of the plane triangle.

When cos C is a maximum C = O. In this case $a^2 + b^2 = 3\,a\,b$, or $1 + \frac{b^2}{a^2} = 3\frac{b}{a}$; which solved as a quadratic gives $\frac{b}{a} = \frac{3 + \sqrt{5}}{2} =$ 2·618 nearly. This is the maximum inequality in the sides, so as to have equal areas.

In like manner, the value of the angle may be found for any given ratio of the containing sides within these limits; or the angle being given, the ratio of the sides may be found. To save the trouble of these calculations, I have constructed the small table in the margin, which shews for given ratios of a and b the value of C with which the spherical and plane triangles have equal areas. If the sides were so large in regard to the radius, that the terms omitted could sensibly affect these results, it would be necessary to take into account those of the next, and perhaps also of higher orders.

$\frac{b}{a}$	Cos C	Log cos C	C
1·0	$\frac{200}{300}$	9·82391	48°·11′
1·1	$\frac{221}{330}$	·82588	47·57
1·2	$\frac{244}{360}$	·83109	47·20
1·3	$\frac{269}{390}$	·83869	46·23
1·4	$\frac{296}{420}$	·84804	45·11
1·5	$\frac{325}{450}$	·85067	43·46
1·6	$\frac{356}{480}$	·87021	42·08
1·7	$\frac{389}{510}$	·88238	40·18
1·8	$\frac{424}{540}$	·89498	31·16
1·9	$\frac{461}{570}$	·90783	36·01
2·0	$\frac{500}{600}$	·92082	33·33
2·1	$\frac{541}{630}$	·93386	30·50
2·2	$\frac{584}{660}$	·94687	27·46
2·3	$\frac{629}{690}$	·95980	24·16
2·4	$\frac{676}{720}$	·97262	20·08
2·5	$\frac{725}{750}$	·98528	14·50
2·6	$\frac{776}{780}$	·99777	5·48

To ascertain the actual difference in the areas of the spherical and plane triangles in an extreme case, suppose an equilateral with sides of $1\frac{1}{2}$ degrees: the direct formula gives the excess = 61″·217; and the difference in the areas of the two triangles will be 0·3951 square miles, corresponding to an excess of 0″·005245: One-third of this would be the error on each angle, and, were it ten times as great, it would still be, in Troughton's phrase, a quantity less than what is visible in the telescope.

It is almost needless to remark that the supposed triangle is larger than any which has yet occurred in practice. The great triangle in the French arc, (long supposed to be the largest in the world), has an

excess of about 39″. I have had one observed by day-light on which the excess was about 40″.5. The least side was 80 and the largest 92 miles. Such a triangle does not often occur, but even this had about $\frac{2}{3}$ only of the area of that on which the difference has been shewn to be utterly insensible.

But as the greatest difference occurs when C exceeds a right angle, we may find the particular angle giving a maximum difference of area by making $\frac{a\,b}{24}\left\{(a^2+b^2)\sin C - 3\,a\,b\sin C\cos C\right\}$ a maximum. By differentiating, we have

$$\frac{a\,b}{24}\left\{(a_2+b^2)\cos C - 3\,a\,b\cos 2\,C\right\}\mathrm{d}\,C = 0$$

whence the maximum corresponds to $\frac{a^2+b^2}{3\,ab} = \frac{\cos 2\,C}{\cos C}$

This hardly admits of being solved directly, but the indirect solution is very easy.

Since C must be greater than a right angle, we may put $C = 90 + \chi$; whence $\frac{\cos 2\,C}{\cos C} = \frac{\cos 2\,\chi}{\sin \chi}$: and since $\frac{a^2+b^2}{3\,ab}$ is always +, it is plain that χ cannot be less than O nor exceed 45°. Hence the quantity $\frac{\cos 2\,\chi}{\sin \chi}$ will pass through all its values from o to ∞ in every half quadrant.

C	$\mathrm{Log}\frac{a^2+b^2}{3\,ab}$	C	$\mathrm{Log}\frac{a^2+b^2}{3\,ab}$	C	$\mathrm{Log}\frac{a^2+b^2}{3\,ab}$
90	+ ∞	105	0·52453	120	0·00000
91	1·75788	106	·48808	121	9·95977
92	·45612	107	·45264	122	·91763
93	·27881	108	·41798	123	·87320
94	·15217	109	·38389	124	·82601
95	·05306	110	0·35020	125	9·77546
96	0·97117	111	·31674	126	·72076
97	·90101	112	·28336	127	·66088
98	·83929	113	·24989	128	·59433
99	·78387	114	·21620	129	·51901
100	·73332	115	0·18212	130	9·43160
101	0·68657	116	·14750	131	·32661
102	·64285	117	·11217	132	·19372
103	·60157	118	·07595	133	8·00980
104	·56226	119	·03864	134	7·70105
105	·052453	120	0·00000	135	— ∞

By tabulating this, as in the margin, for every degree of χ, we may readily find, for any given ratio of the sides, the approximate angle giving a maximum difference of areas.

By means of this and the former Table, it will appear, that with equal sides the angle of maximum difference of areas is somewhat greater than 124°, and by a nearer computation the exact value of C will be found 124°· 02′·35″, being the greatest angle, giving a

maximum difference of areas. For any other ratio of sides the angle will be smaller. For the ratio $\frac{3 + \sqrt{5}}{2}$ the angle is 120°. When the ratio is $\frac{10}{1}$ the value of $\frac{a^2 + b^2}{3\,ab}$ is $\frac{101}{30}$, the log of which 0·52720 corresponds to a value of C somewhat less than 150° or 140°.55′.45″; and so in other cases. When the ratio of the sides becomes indefinitely great, the maximum difference angle approaches indefinitely near to 90°.

In well chosen triangles there is not usually any very great differences in the sides, and hence, practically, the greatest differences of area will usually occur when C is not far from 120°.

If, for example, we suppose a triangle with sides of a degree each, and containing an angle of 120°, by the original formula, the excess is 27″.210; and the difference in area between the spherical and plane triangles is 0·18214 square miles, the excess corresponding to which is 0·0024176. On a triangle with degree sides and the maximum angle 124°.02′.35″, the excess is 26″.035: the difference of areas is 0·18320 square miles, the excess corresponding to which is 0″.0024318. Such differences, though utterly insensible in the telescope, are still much greater than have ever occurred in practice; for though a single side of more than a degree be nothing very extraordinary, it is but rarely that two such sides can be found forming a triangle with a third side of from 118 to 120 miles.

The difference here treated of is, in similar triangles, proportional to the 4th powers of the homologous sides: Hence, in an equilateral with half degree sides, this difference would be $\frac{1}{81}$ of 0″·005245, or 0·00006475; and on the isosceles with half degree side containing 120°, the difference would be $\frac{1}{16}$ of 0″·0024176, or 0″·00001511. Triangles such as these are not very uncommon, but it is much more common to have triangles with less than half of their area.

It is thus fairly proved that the difference between the excess on a spherical triangle computed rigorously and the excess deduced by reckoning its area as equal to that of a plane triangle with the same sides and contained angle, is a quantity so small that, even in extreme cases, the neglect of it will not induce any sensible error; and that, on triangles such as usually occur in practice, the difference is so utterly insignificant that to go much out of the usual way in order to take account of it, would be a very needless refinement.

A Note on Capt. Shortrede's *Remarks in No. CXXIII. (Page 240) of this Journal. By* S. G. T. Heatly, *Esq.*

The subjects of geometry are not the creatures of arbitrary definition. We strive first to attain such a definite conception of them as enables us to see how their properties follow from their nature: we enunciate this conception as well as we can in words, and call it the *definition*. But we cannot, however, enunciate the process of intuition by which we are conscious of the necessary consequence of any the most rudimentary property. We are compelled therefore to put down this rudimentary property itself; it is termed an *axiom*. Hence the indispensable appearance of axioms in a system of geometry.

On these grounds I agree entirely with the position that, in mathematical definitions, it is necessary to have a clear conception of the idea, and then to use such words as will convey that conception to the mind of another. It did not appear to me that a clear conception of the idea of an angle is generally entertained; and I endeavoured to analyse the language commonly held on the subject, so as to detect the peculiarity which impressed itself on the minds of various authors, and to shew that the idea of an angle involved the conceptions—of surface —of determinate extension in the direction of width—of indeterminate extension in the direction of longitude. These are conceptions which every one, sooner or later, finds floating in his mind clearly or obscurely, and if they enable the student to perceive distinctly what he is about when he is discussing angles, it is our business to place them before him in the simplest and most direct form.

The use made of the word *direction* arose from the habit of always reducing geometrical magnitudes and positions along fixed axes, the two axes being in this case (I need not say) one bisecting the angle, indicating the direction of length—and one perpendicular to it, indicating the direction of width. This appeared to me necessary to embody distinctly the conceptions intended to be impressed.

To the axiom I cannot conceive any objection raised: it is merely an application of the principles of geometrical equality to angular magnitude. The real "pinch and nip" (to use Colonel Thompson's significant expression) lies in the perception of the truth that whatever applies to an angular space, applies to its angle. This is the elemen-

tary property which must be clearly seized: for which purpose we may put it thus: Let the angle and the angular-space be in any ratio, say $a : b$. Then *á dividendo* the angle is to the difference between it and the angular space, a finite rectilineal figure, as $a : a\text{-}b$. But the angle is infinitely greater than the finite rectilineal figure: hence a is infinitely greater than $a—b$, whence the latter is zero, or $a=b$, and the angle = the angular space.

The matter lies in a simple compass: if the angle be not an infinite surface, what is it? If it be, it must be discussed according to its nature. There can be no arbitrary limitations to the province of geometry: if you will adhere to them, you must try to do without angles, for they are interlopers. The Greek confined himself to the geometry of the line and the circle, and did wonders therewith; but the trisection of the angle and the duplication of the cube required him to extend his armory. The Italian (Mascheroni) yet more chivalrous, used only the circle: but his was a tilt-yard exercise. The only oath administered to the candidate for mathematical knighthood is, that he shall seek always for Truth in the realms of Space and Number, and that he will do his devoirs with every lawful weapon of sound logic. The attempt to assign forced and arbitrary limits to things which do not admit of them, has always been productive of mischievous consequences in retarding our onward progress in physics as in legislation, in poetry as in mathematics.

Errata in the Essay on Angular Geometry.

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,,	,,	,,	6	,,	This line should run thus: Let A C meeting A B, not meet *its* parallel E D, consequently, &c.			

Descriptive Notice of the Bat described as Taphozous longimanus, by Gen. Hardwicke. *By* Edw. Blyth, *Curator to the Asiatic Society.*

Upon a former occasion (in vol. X. p. 971 *et seq.*,) I described three Indian species of *Taphozous*, doubtfully identifying one of them with the *T. longimanus*, Hardwicke (*Lin. Trans.* XIV. 525); but I have since obtained a species which I cannot doubt is the animal so named by that naturalist, bringing the number of ascertained Indian species of this genus to four, of which the present is the only one previously known to the publication of my former memoir. It remains, therefore, to impose a distinctive appellation upon the species which I then cited doubtfully as *T. longimanus*, and which I now propose to designate *T. Cantori*, in honour of the accomplished naturalist who favored me with the specimen.

The *T. longimanus* deviates in some particulars from the detailed account which I gave as of generic application, the ears of this species not lying flatly outward—as in the *Rhinopomata* and *Dysopodes*, and as in the recent *T. Cantori*, but remaining suberect, as usual in other *Vespertilionidæ :* hence the measurement of nine-tenths of an inch between them, given by Gen. Hardwicke, is intelligible; whereas in *T. Cantori* I could not recognise it, nor well understand where it had been taken: again, the tail when exserted by the collapse of the interfemoral membrane does not curl round upward, as in *T. Cantori*, nor has any tendency that way, but remains out straight, with but slight capability of bending except at its extreme base: the nostrils do not appear capable of closure, which leads me to doubt whether this be truly the case in the other species. I observe, both in the present species and its congeners, two remarkable characters which may be added to the diagnosis of the genus: viz., the double flexure outward of the extremity of the closed wing, which always collapses in this manner, whereas in other Bats the wing does not naturally so fold, but the tip turns inward; in connexion with which may be mentioned that the first digit in *Taphozous* consists of but one phalanx terminating in a *(quasi)* joint-knob, whilst in most other Bats (*Rhinolophus* appears to be an exception) there is a small second phalanx more or less developed beyond this, and in the Pteropodine group two additional phalanges with a terminal claw (the latter only being absent in *Cephalotes*, Geoff., in which was comprised *Hypodermis*,

Is. Geoff.); secondly, the testes, in *Taphozous* (as in *Megaderma*, and I presume *Rhinolophus*), are situate as in man and the monkey tribe, whereas in the restricted *Vespertilio* group they are placed posterior to the anus, and in the Pteropodine section laterally to the penis; this being a character which may help to indicate the primary divisions of the family: the magnitude of the genitals is a remarkable feature of the Vespertilionine subdivision generally, being in some species quite inordinate; but this is not the case in *Taphozous*, wherein the penis wholly withdraws internally. Finally, it may be remarked that the feet and tail of this genus have always a few scattered long and slender hairs; and that the fore-arm is more than usually curved at the basal third.

The specimen of *T. longimanus* before me (an adult male) measures four inches and one-eighth to tail-tip, the membrane extending five-eighths of an inch beyond; expanse fifteen inches and a half, and length of fore-arm two inches and three-eighths; the tail an inch, capable of being wholly sheathed within the membrane, and of protrusion for five-eighths of an inch: ears, measured internally, from base of lowermost lobe, nine-sixteenths of an inch, and externally half an inch: no upper incisors, as likewise in the examples of the three other species described by me: the throat-sac particularly large, measuring three-eighths of an inch wide, and thickly lined with a hard and fœtid exudation; there is also a small circular second cavity, a quarter of an inch posterior to the first, and yielding a similar secretion; this is also perceptible, but rather less developed, in *T. fulvidus:* the fur is close and velvety, of a dark brown colour, slightly grizzled with a pale hue at the tips, and not white at base as in *T. Cantori* (which species has the throat-sac merely rudimentary); beneath it is scarcely paler than above, but the throat is deeply tinged with rufous: membranes brownish-dusky.

The *T. longimanus* is stated by Gen. Hardwicke to be "common in Calcutta, in dark store-rooms; at night it frequents habitations, attracted by the light of the candles and numerous insects." The present specimen was shot in a rural situation, two or three miles from Calcutta; and, I may remark, rather late in the evening, when I had been waiting some little time for an opportunity to discharge my second barrel, prior to returning from a Bat-shooting excursion;

hence, as its stomach was quite empty, I think it probable that the members of this genus do not leave their retreats so early as the ordinary *Vespertiliones;* indeed I have often wondered that, considering the great number of Bats which I have lately shot, I could never thus meet with any not appertaining to the sub-genera of restricted *Vespertilio*, save only the great *Pteropus Edwardsii* and the *Pachysoma marginatum*, both of which are abundant. The Bats that fly round the dinner-table of an evening are oftentimes a little tantalizing to a zoologist, though it is not often he would succeed in catching them if he made the attempt, since the rooms in this part of the world (as the European naturalist may be reminded) are lofty and spacious, with open doors and windows in all directions. Still I must say I cannot think that the *Taphozoi* are frequent visitors.*—Nov. 22d, 1842.

Proceedings of the Asiatic Society.

(Friday evening, 15th July, 1842.)

The Hon'ble W. W. Bird, in the chair.

The following Books were presented.

Books received for the Meeting of the Asiatic Society, on the 15th July, 1842.

The Oriental Christian Spectator, April 1842, Vol. III. No. 4.

The Calcutta Christian Observer, July 1842. Vol. III. No. 31.

The Calcutta Literary Gleaner, 1842, Vol. 1, Nos. 3 and 5.

Annual Report of the Transactions of the Bombay Chamber of Commerce, 1840-41.

London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science, Vol. XX, No. 130.

The Annals and Magazine of Natural History, Vol. VIII. No. 54, and Vol. IX. No. 55.

Journal des Savants, Novembre et Decembre, 1841.

Pemberton's Report on Bootan, Calcutta, 1839, from Government.

Macpherson's Report upon the Khonds of the districts of Ganjam and Cuttack, Calcutta, 1842.

Catalogue of the Physiological series of Comparative Anatomy, contained in the Museum of the Royal College of Surgeons in London, 1840, Vol. V.

Summer; or, the causes, appearances, and effects of the Grand Nuptials of Nature, by R. Mudie, London.

Narrative of an Expedition to the Polar Sea, in the years 1820, 1821, 1822, and 1823, by the Baron Von Wranzell, translated by E. Sabine, London, 1840.

Glossarium Archaiologicum: Authore H. Spelmanno, Londoni, 1687.

* Some annoying typographical errors occur in my former paper on the *Taphozoi*, consequent upon making a slight alteration in the text when correcting the proofs. In vol. x, p. 972, 2nd line, read "*Loret Volant* of Daubenton, styled *Senegalensis* by M. Geoffroy;"—4th line, read—"a fourth is described by M. Geoffroy, as *F. Mauritanus;*"—close of 18th line, read "Raffinesque;"—and at p. 973, line 21, for altitude read "attitude." E. B.

Read letter from J. H. Batten, Esq. Almorah, 27th June 1842, reporting that Mr. Lushington was sending a magnificent collection of Ores, which would do admirably for the Museum of Economic Geology, and that the continuation of Capt. Manson's Journal was just now suspended, because Lieut. Weller, Executive Engineer and Junior Assistant to the Commissioner of Kemaoon had lately visited the Juwahir Pass, and among other things, had with his own eyes seen "*millions upon millions of maunds of Ammonites*" on the hills sloping down from the Pass into the valley of the Sutlej, and that he wished to enrich his side notes with Extracts from the Journal of his Correspondent on his return to Almorah.

Read letter from Lieut. A. Cunningham, of 18th June 1842.

My dear Torrens, *Lucknow, 18th June*, 1842.

I send you a packet of English Coins to be offered to the Asiatic Society for sale; and a small packet of Roman Coins to be presented to the Museum.

I enclose a list of the English Coins, silver and copper, with their prices. They form a small collection; but amongst them, are some rather scaree Coins.

I have a fine Sassanian collection to dispose of, which perhaps the Society might like to take. If so, kindly let me know, and I will make out a list, with the prices of the Coins attached.

Believe me,

Most sincerely yours,

Alex. Cunningham.

LIST OF ENGLISH COINS.

Nos.	*Silver.*	*Denomination.*	*Value.*			
1.	Edward 4th	groat, ...	5	0	0	
1.	Elizabeth, ...	shilling, ...	1	0	0	
1.	Ditto, ...	six pence, ...	2	0	0	
2.	Ditto, ...	pennies, ...	2	0	0	
1.	Ditto, ...	half penny, ...	5	0	0	
1.	James 1st, ...	six pence, ...	1	0	0	
1.	Ditto, ...	penny, ...	1	0	0	
1.	Charles 1st, ...	shilling, ...	5	0	0	
1.	Ditto, ...	six pence, ...	2	0	0	
1.	Ditto, ...	two pence, ...	1	0	0	
1.	Commonwealth, ...	two pence, ...	5	0	0	
2.	Charles 2nd, ...	three pence, ...	1	0	0	
1.	Ditto, ...	three pence, ...	5	0	0	by Simon.
1.	Ditto, ...	two pence, ...	0	8	0	
+ 1.	William 3rd, ...	half crown, ...	2	0	0	
1.	Ditto, ...	four pence, ...	0	8	0	
1.	Ditto, ...	three pence, ...	0	8	0	
1.	Anne, ...	four pence, ...	0	8	0	
4.	George 2nd, ...	six pence, ...	2	0	0	
1.	Ditto, ...	three pence, — ...	0	8	0	
1.	Ditto, ...	two pence, ...	0	8	0	
1.	George 3rd, ...	shilling, ...	4	0	0	
2.	Ditto, ...	six pence, ...	1	0	0	
1.	Ditto, ...	four pence, ...	0	8	0	
3.	Ditto, ...	three pence, ...	1	0	0	
1.	Ditto, ...	penny, ...	0	8	0	
+ 1.	William and Mary, ...	shilling, ...	1	0	0	
1.	Ditto, ...	two pence, ...	1	0	0	
37.			52	0	0	
	Copper.					
	James 1st, ...	small coins, ...	2	0	0	
1.	Charles 2nd, ...	farthing, ...	0	8	0	
1.	Anne, ...	token	1	0	0	
2.	William and Mary, ...	farthings, ...	0	4	0	
2.	George 2nd, ...	farthings, ...	0	4	0	
			4	0	0	

Totl, 52 + 4 = 56 Rupees.

It was ordered, that the English Coins offered, be purchased, and that the thanks of the Society be communicated to Lieut. Cunningham, for his presentation of the Roman Coins.

Read letter from H. M. Elliot, Esq. Secretary Sudder Board of Revenue at Allahabad, dated the 29th June last, forwarding selections from correspondence respecting the proposed formation of a Canal for irrigation to be supplied from the River Jumna, near the village of Kuttha Putthur in the Deyrah Doon.

Referred to the Secretary for publication in his Journal.

Read letter of 30th June last, from R. H. Mytton, Esq. Magistrate 24-Pergunnahs, requesting return of some Coins found by a convict, or their value Co.'s. Rs. 36.

Ordered, that the Coins be purchased for the Society, and their value forwarded to Mr. Mytton.

Read the following Report from the Curator:—

Sir,—In the class of Mammalia, I have nothing of particular interest on which to report. We continue to receive such animals as are entrapped or shot at the Botanic Garden, which are always acceptable for exchange or transmission elsewhere; and I have especially to thank Mr. Jos. De Cruz of that establishment, for his kind attention to my wishes in this respect.

In that of Birds, our acquisitions, since the last meeting, have been very extensive.

1. From B. H. Hodgson, Esq., British Resident at the Court of Nepâl, I have the gratification to announce the arrival, as a donation to the Society, of 270 species of birds, whereof four specimens respectively are sent of the greater number (though it is to be regretted that many are in very imperfect condition); and there are seventy species which are new to the Museum, while above 100 are more or less common in this neighbourhood.

2. Mr. Frith has forwarded to the Society specimens of

Budytes citreola, or, I rather suspect, an allied species which is also met with in this neighbourhood.

Esacus recurvirostris, Lesson (1831): *Pseudops* (olim *Carvanica) grisea*, Hodgson, *J. A. S.* V, 776; *Œdicnemus recurvirostris*, Swainson.

Rhynchops flavirostris.

3. Mr. Mackay has kindly permitted me to select from a very interesting collection of Malayan birds received from Singapore, examples of such species as are wanting to the Museum, for which I have given duplicate specimens in exchange; and Dr. Spry has also favored me with a like permission in the instance of another collection of Malayan birds, for which I have also looked out a somewhat extensive series of duplicates for transmission to the Cornish institution at Truro. Our acquisitions in this manner consist of the following species, of which those new to the Museum are marked with an asterisk.

Palœornis Malaccensis, Vigors: *Psittacus Malaccensis*, Gmelin, but not of Latham, which refers to the next species. A more beautiful specimen than I remember

to have seen before. Middle tail-feathers eleven inches and a half long, and uniform bright purple; the collar between the black moustache and the emerald cap of the finest peach-blossom hue, heightened on the nape (like the crown of *P. Bengalensis)* with a cœrulean bloom; and the rest of the colours exquisitely brought out.

**Psittinus* (Nobis) *Malaccensis: Psittacus Malaccensis*, Latham, but not of Gmelin; *le petit Perruche de Malacca*, Sonnerat. This bird cannot be arranged in *Psittacula* of Kuhl, where generally located, if *P. galgulus* is to be regarded as typical of that division; but, though having a short tail, the rest of its structure places it in immediate proximity with *Palœornis*, while a further token of this affinity exists in the maronne wing-spot, seen also in *Pal. Alexandrinus, schisticeps*, and *Bengalensis*. The allied *Ps. setarius* of Temminck, an inhabitant of Borneo, presents an additional approximation to *Palœornis* in having its two middle tail-feathers much elongated beyond the rest, though remarkable for being partly naked-shafted. I add a description of the specimen before me. Length nearly seven inches, of wing four inches and three quarters, and tail an inch and seven-eighths, the three first primaries being equal and pointed (as in *Palœornis)*, and reaching to the end of the short tail, which latter consists of somewhat narrow feathers resembling those of *Palœornis*, even though not elongated, the outermost being but a quarter of an inch shorter than the middle ones. Beak coloured as in *Palœornis* generally, or having the upper mandible bright coral-red with a white tip, and the under one dusky; its form precisely as in that genus. Crown, rump, and upper tail-coverts, bright purplish smalt-blue, passing on the crown into the greyish-dusky colour of the back; under-parts dull yellowish-olivaceous, the mesial portion tinged with brownish-ruddy: lower tail-coverts yellowish-green tipped with blue; and tibial plumes mingled blue and green: uropygials deep green, and the rest of the tail-feathers yellow, more or less green-edged: wings deep green, margined with yellowish on the coverts, except those of the primaries which are wholly purple: maronne wing-spot before noticed; and the coverts underneath the wing are brilliant crimson, as are also the axillaries, which must shew to advantage as the bird is flying overhead, and induce the expectation that the species is much handsomer than it proves on closer examination.

Ierax cœrulescens, Vigors. I am now acquainted with three species of these very diminutive Falcons, viz. in addition to the present one,—*I. erythrogenys*, Vigors, *P. Z. S.* 1831, 76, (from Canton,)—and a Nepâlese species, rather larger than the others, contained among the specimens sent by Mr. Hodgson, and which is the *Falco Bengalensis* of the old authors, currently but erroneously identified with *I. cœrulescens*.*

* A live specimen of *I. cœrulescens* has lately been received by Dr. M'Clelland from Assam; and the aspect of the living bird gives the idea of a larger species than would be supposed from examination of preserved skins, as it puffs up its feathers much, in a manner which can only be successfully imitated when mounting a recent specimen.

It is not generally known that these tiny Falcons are trained for hawking in the Upper Provinces of India, being flown at Quails and other game of corresponding size, as I have been informed by different eye-witnesses of the sport, which is thus described in Capt. Mundy's 'Sketches of a Tour in India,' II, 25. "We had also some amusing sport with another kind of Falcon, a very small bird, perhaps barely so large as a Thrush, and its prey was proportioned to its strength. It is flown at Quails, Sparrows, and others of the feathered tribe, of like calibre. The mode of starting it is different from that used with any other hawk. The falconer holds the little,

**Ceyx tridactyla*, Lacepede; the so called first variety described in Shaw's Zoology,' Vol. VIII, pt. II, 104.

Bucco gularis, Temminck.

Picus mentalis, Temminck, — not of Jerdon, *Madr. Jl.* Vol. XI, 214, which is *P. Nipalensis* of Hardwicke and Gray, badly figured in their 'Illustrations of Indian Zoology.'

**Cuculus (Pseudornis*, Hodgson,*) lugubris*, Horsfield, *Lin. Trans.* XIII, pt I, p. 179, and figured in the 'Zoological Researches in Java' of the same naturalist: *C. albopunctulatus*, Drapiez, *Dict. Class. d'Hist. Nat.*, Art. *Coucou.* A rare species in collections, and nearly allied to the *Pseudornis dicruroides*, Hodgson, *J. A. S.* VIII, 136.

**Rhinortha* (Vigors,—*Anadœnus*, Swainson,) *chlorophœa; Cuculus chlorophœus*, Raffles, *Lin. Trans.* XIII, pt. II, p. 288.

Eurylaimus Sumatranus, Raffles: *Eu. Corydon*, Temminck.

Eu. ochromalus, Raffles: particularly fine.

Calyptomena viridis, Raffles: male and female.

Irena puella, Horsfield: female.

Vanga cristata, Vieillot.

Edolius balicassius verus, adult and young: *E. affinis*, Nobis, Vol. XI, p. 174. I doubt whether this species occurs in India, being replaced here by *E. Fingah*, v. *albirictus*, Hodgson, which is the Indian *balicassius*, Auctorum. I append a Monograph of the Asiatic species of this genus at the close of the present report.

Lanius strigatus, Eyton, *P. Z. S.* 1839, p. 103. Four specimens, all in the obviously immature livery described by Mr. Eyton, and also by myself. (Vol. XI, p. 203).

**Tephrodornis sylvicola*, Jerdon, *Madr. Jl.* No. XXV, 237. This bird appears also to be very common in the Tenasserim provinces.

Muscipeta atriceps, Nobis, Vol. XI, p. 203. The fully mature male of this species has the dorsal region very rich deep ferruginous-bay, with a fine purplish gloss, and all the colours more intense than in the specimen formerly described by me.*

well-drilled savage within the grasp of his hand, the head and tail protruding at either opening, and the plumage carefully smoothed down. When he arrives within twenty or thirty yards of the quarry, the sportsman throws his hawk much as he would a cricket-ball, in the direction of it. The little creature gains his wings in an instant, and strikes his game after the manner of the *Bhause* [Goshawk.]

"There is a queer tribe of gregarious little birds, common in India, which afford very laughable sport with the above mentioned hawk. They are usually found in a chattering fluttering congress of ten or a dozen, at the foot of some baubul tree; where the little busy-bodies are so absorbed in the subject under immediate agitation, that the falconer may approach within six paces of their noisy court of parliament ere they entertain a thought of proroguing it [*Malacocercus* ——— is probably the species meant]. In the heat of debate, down comes the little Hawk (like some Cromwell) into the midst of the astonished assembly, and begins to lay about him right and left; when strange to say, the whole tribe set upon him, *unguibus et rostris*, and with a virulence of tongue as manifestly vituperative, as if it were couched in words. In the dust of the contest, the sportsman runs up, and all the party take wing, except two or three unfortunates, who, having caught a tartar, lie fluttering in the clutches of the feathered tyrant."

* I have now reason to believe that the latter is a female, whilst the specimen formerly described as female is certainly distinct, and may be designated *M. plumosa*. I shall therefore redescribe the two as follow:—

M. atriceps, Nobis. Length seven inches and upwards, of wing three inches and three-eighths, and tail two inches and five-eighths; bill to forehead (through the feathers) three-quarters

**Muscicapa hirundinacea*, Reinwardt, figured in Horsfield's 'Zoological Researches in Java,' and described by the same naturalist as *M. obscura* in *Lin. Trans.* XIII, pt. I. 146; erroneously identified by Mr. Jerdon with *M. picata* of Sykes, (not of Swainson,) from which it is readily distinguished by having no white on the wings, nor on the exterior border of its outermost tail-feathers, while the bill is also fully a third longer. Inhabits also Tenasserim.

**M. latirostris*, Raffles, *Lin. Trans.* XIII, pt. II, 312, and again so termed by Swainson, *Nat. Libr., Flycatchers*, p. 253: distinct from *M. Poonensis* of Sykes, with which it was suspected to be identical by Mr. Jerdon. I presume this to be the species here indicated, as it differs only from Mr. Swainson's description by having the 4th primary above one-eighth of an inch shorter than the 2nd, whereas the latter is stated by that author to be only as long as the 6th; whence it may be that the feather in question was not fully grown in his specimen. The species there also described by the same author as *M. leucura* (so also named in Latham's 'General History,' though described as new by Mr. Swainson,) is extremely common in Bengal during the cool season; but the same specific name was bestowed by Gmelin upon another species, which should retain it, the more especially as the present one, *i. e.* the male of it, becomes, with full maturity, the *Saxicola rubeculoides* of Sykes, *P. Z. S.* 1832, 92, as first suggested to me by Mr. Jerdon.* Lastly, I may remark that the *M. picata*, Swainson, of Western Africa, described by him in the same place, yields precedence to the Indian *M. picata* of Sykes, and must therefore receive another appellation. I add a description of the skin before me of *M. latirostris*. Length four inches and seven-eighths, of wing two inches and three-quarters, and tail an inch and three-quarters; bill to forehead (through the feathers) half an inch, and three-quarters of an inch to gape; tarse half an inch, and slender. The hue of the upper-parts is darker than in *M. grisola*, being also slightly deeper on the crown; wing-coverts and tertiaries margined with dull fulvous: throat, gorget, belly and under tail-coverts, white, with a slight fulvous tinge on the former; the breast and flanks dull ashy

of an inch and upwards, and tarse somewhat exceeding half an inch. Crown and nape, of the (presumed) male, black with a bright steel gloss; the sides of the head, neck, and breast dark ashy passing into slightly glossed blackish on the throat, and into white on the belly and under tail-coverts: the rest of the upper-parts dark rufo-ferruginous, with a purplish gloss on the back, scapularies, and smaller wing-coverts; the rest of the wing dusky, more or less edged with ferruginous, and broadly so on each side of the tertiaries: bill light horn-colour; and feet apparently plumbeous. The (presumed) female has the colours generally weaker, the glossed tips of the coronal and nape feathers less developed, and no rich purplish gloss upon the back, which is of a dingy and much lighter ferruginous: the under-parts scarcely differ from those of the preceding.

M. plumosa, Nobis. Length (of a supposed female) about six inches and three-quarters, of wing three inches and a quarter, and tail two inches and five-eighths; bill to forehead (through the feathers) nearly seven-eighths of an inch, and tarse five-eighths of an inch. Body plumage very much longer and looser in texture than in the preceding, especially the feathers of the rump, which are of remarkable length and puffy. Upper-parts light olive-brown, tinged with greenish-ash on the crown and ear-coverts; throat and breast pale rufescent, still lighter and passing into white on the belly; wings and tail bright rufo-ferruginous, except the smallest coverts of the former which are hidden by the scapularies, and the primaries and their coverts which are edged with the same colour as the back. Bill pale horn-colour; and feet appear to have been greenish.

* This bird falls under the division *Dimorpha* (olim *Siphya*), Hodgson, *Ind. Rev.* I. (1839), p. 651.

brown, as also the front of the neck contiguous to the ear-coverts, where but a narrow mesial line of fulvous-white passes from the throat to the gorget; bend of the wing beneath, and axillaries, pale fulvous brown; a whitish streak from the nostril to the eye; and bill horny-black, with the basal half of the lower mandible yellow; the latter is broad at base, and evenly attenuating; and the feet apparently are lead-coloured.

Pycnonotus (Kuhl) *melanocephalus : Lanius melanocephalus*, Gmelin; *Turdoides atriceps*, Temminck: not *Brachypus melanocephalus* of Hardwicke and Gray, which I followed in so designating—Vol. XI, p. 168, where I identified with it the *Vanga flaviventris*, Tickell, *J. A. S.* II, 573, though it is far enough removed from a typical *Vanga*. The present is clearly enough the species referred to *Turdoides atriceps*, Tem. *Pl. Col.* t. 147, in Griffith's 'Animal Kingdom,' VI, 389, and again in 'Shaw's Zoology,' VII, 330; but as both descriptions are brief and defective, I subjoin the following. Length six inches and a quarter, of wing two inches and seven-eighths, and tail, which is considerably rounded, two inches and a half, its outermost feather being above three-eighths of an inch shorter: bill to forehead (through the feathers) nine-sixteenths of an inch, and to gape three-quarters of an inch: tarse barely half an inch. General colour olive-green, brightening to yellow on the upper and under tail-coverts, belly and flanks: the whole head and throat glossy black: primaries and inner webs of the tertiaries dusky-black, as also the other wing-feathers interiorly; and tail greenish for the basal two-thirds, then dusky-black, and tipped with yellow more developed on its lateral feathers. The irides are in this genus, usually, if not always, crimson. A young specimen is rather smaller in all its dimensions, but scarcely less bright in colouring, except on the head and throat, where the black is merely indicated. In both, the plumage of the rump is black at base, broadly margined with yellow, as in certain allied species.

P. (?) cyaniventris, Nobis. Length six inches and a quarter, of wing three inches and one-eighth, and tail two inches and seven-eighths; bill to forehead (through the feathers) nearly five-eighths of an inch, and to gape eleven-sixteenths of an inch; tarse half an inch. Colour of the upper-parts uniform yellowish olive-green; the head, neck, and under-parts uniform dark bluish ash-colour, bordering on plumbeous, except the lower tail-coverts which are bright yellow, as are also the edges of the wings anteriorly: primaries dusky, together with the inner and terminal portions of the caudal feathers. Bill dusky, and legs lead-coloured. I place this bird provisionally in this genus, though far from satisfied of the propriety of so doing. As compared with the preceding species, the bill is more Thrush-like, though small; the nostrils very different; the gape furnished with much smaller and less conspicuous setæ; the tail even, or all but so; and the claws less minute; the *ensemble*, in a word, is different, though the technical characters sufficiently apply.

**Chloropsis Malabaricus :* adult and young.

**Parus Sumatranus (?); Melanochlora Sumatrana (?)*, Lesson, as quoted by Mr. G. R. Gray ('List of the Genera of Birds, with their Synonymes,' 1st edit., p. 23), who, doubtfully identifying with it the *P. flavocristatus*, Lafr., v. (apud Horsfield) *P. sultaneus*, Hodgson, I think there can be little doubt that the bird now before me is referred to. This only differs from *P. sultaneus* in its inferior size, and in the rounded form of the crest, which does not consist, as in the other,

of pointed feathers. Length seven inches and a quarter, or probably as much as eight inches in the recent specimen; of wing four inches; and tail three inches and a half: bill to forehead (through the feathers) nearly five-eighths of an inch, and to gape three-quarters of an inch; tarse three-quarters of an inch. Colour of the upper-parts, wings, and tail, throat, neck, and breast, deep black, without the green shine of *P. sultaneus:* and top of the head, belly and lower tail-coverts, brilliant yellow, the coronal feathers lengthened but rounded. Bill black, and feet bluish lead colour. Possibly enough, this may yet prove to be the *P. flavocristatus* of M. Lafresnoy, rather than Mr. Hodgson's *P. sultaneus.*

* *Timalia pectoralis*, Nobis. Beak nearly resembling that of *T. pileata*, Horsfield, but longer, less laterally compressed, and not quite so deep. Length about six inches and a half, of wing three inches and a quarter, and tail three inches, the latter scarcely rounded, but the outermost feather five-sixteenths of an inch shorter than the next, which again does not quite equal the others; bill to forehead (through the feathers,) three-quarters of an inch, and to gape fifteen-sixteenths of an inch; tarse an inch: colour of the upper-parts, to the rump, olivaceous, the coronal feathers darker along their centres; throat black, and feathers of the fore-neck and breast also black, but each elegantly and conspicuously margined with white: rump, upper tail-coverts, and basal margins of the *rectrices*, bright rufo-ferruginous, the rest of the tail-feathers reddish-brown, tipped and slightly edged with rufous; flanks olivaceous; the lower tail-coverts ruddy: bill dusky-black, the lower mandible whitish underneath; and feet leaden-dusky. A supposed female is rather smaller in all its dimensions, with the breast-markings less developed.

* *T. erythronotus*, Nobis. Bill as in last, but rather less elongated. Length six inches to six and three-eighths, of wing two inches and a half to two and three-quarters, and tail two inches and a quarter to two inches and a half; bill to forehead (through the feathers) eleven-sixteenths of an inch, and to gape seven-eighths of an inch; tarse seven eighths of an inch. Colour of the upper-parts deep rufo-ferruginous; the forehead black, with whitish lateral margins to the feathers, imparting a striated appearance; crown and back of the neck dull rufous-brown, passing into the ferruginous of the back and wings; and sides of the neck, with the under-parts from the breast, dark fuscous-ashy; throat and breast black, the bordering feathers of the latter having a subterminal narrow white bar; above the eye also black, and a small white line passing from the eye backward; likewise a white moustachial patch near the base of the lower mandible: tail much graduated, and, with the primaries, dusky edged with rufous; the lower tail-coverts dark faintly rufous brown: bill black, white at base of lower mandible; and feet dusky-leaden.

* *T. striata*, Nobis. A small species, with proportionally shorter bill than in the preceding. Length five inches and a half, of wing two inches and a half to two and five-eighths, and tail two inches, the outermost feather three-eighths of an inch shorter; bill to forehead (through the feathers,) nearly five-eighths of an inch, and to gape almost seven-eighths of an inch; tarse three-fourths of an inch. Head and neck above black, or rather brown-black, the feathers of the mesial line white about the shaft, forming a streak of this colour along the middle of the head, besides which are two slight lateral streaks not observable in every specimen, in addition to a superciliary line of the same: on the nape the white centres of the feathers broaden and are

more irregularly disposed, while on the back they become much narrower again, more or less so in different specimens, and wholly disappear on the rump; the ground-hue of the back and rump is rich fulvous-brown, brightening on the latter, and tending to rufous on the upper tail-coverts: lores conspicuously pale fulvous, and the throat and foreneck fulvous-white, the ear-coverts margined with black; sides of the breast white, handsomely bordered with black, and a very slight margin of the same to the medial pectoral feathers; rest of the under-parts white, the flanks bordered with fulvous-brown, which spreads nearly over the whole feather posteriorly; lower tail-coverts more or less tinged with the same; wing-feathers dusky interiorly, the coverts having terminal longitudinal white spots; and tail ruddy-brown, margined with more rufous brown at base: bill black, and legs (in the dry specimen) yellowish-white.

**T. erythroptera*, Nobis. Another small species, with bill very like those of some of the small Soras or Water-crakes. Length five inches and a quarter, of wing two inches and a quarter, and tail two inches, its outermost feathers three-quarters of an inch shorter than the middle ones; bill to forehead above five-eighths of an inch, and to gape three-quarters of an inch; tarse a little exceeding three-quarters of an inch. Upper-parts rufous olive-brown, darker on the head, the wings bright rufo-ferruginous; fore-head, sides of head, throat, fore-neck, and breast, ash-colour, becoming paler towards the belly; flanks pale fulvous-brown, bill dusky, and legs apparently yellowish.

T. gularis, Horsfield; figured in the 'Zoological Researches in Java': *Prinia pileata*, Nobis, Vol. XI, p. 204. The difference in the bill from *T. pileata* is so remarkable, that I hope I may be pardoned for not formerly looking among the described species of *Timalia* for this species, which Dr. Horsfield described from a Sumatran specimen, and I have now seen from the Malay peninsula and Tenasserim. The *T. pileata*, discovered by Dr. Horsfield in Java, was met with by Dr. McClelland in Assam, and the Society's Museum contains a specimen of it from Upper Bengal; this bird is also included in Major Franklin's Catalogue.

T. chloris*; *Iora chloris*, Hodgson, *M. S.: probably *Motacilla rubicapilla*, Tickell, *J. A. S.* II. 576, though the description there applies equally to this and the preceding nearly allied species. It differs from *T. gularis* by having the upper-parts pale olive-green instead of brown, the rusty cap much paler and less spread, and the gular streaks are fewer and narrower. Length about five inches, of wing two inches and three-eighths, and tail two inches, its outermost feather but a quarter of an inch shorter, which is less than in *T. gularis*; bill to forehead five-eighths of an inch, and to gape nearly three-quarters of an inch; tarse five-eighths of an inch. The yellow tinge to the breast is, in some specimens, scarcely less deep than *T. gularis*, whilst in others it is scarcely discernible: bill and feet pale. Lieut. Tickell writes, of his *M. rubicapilla*,—"Female: five inches, eyes reddish-hazel; bill and legs pale horn. * * * Found in the thick underwood, hollows, ravines, &c. is lively and agile, with a frequent piping note and occasional chatter." *List of Birds collected in the Jungles of Borabhúm and Dhulbhúm.* I notice this species here for the convenience of describing it along

* Mr. Hodgson has since proposed the subdivisional name *Mixornis* for this bird, and the preceding species ranks with it.

with its congeners. It is comprised among the specimens presented to the Museum by Mr. Hodgson.*

* *Macronous ptilosus*, Jardine and Selby, *Ill. Orn.* pl. CL. : *Timalia trichorrhos*, Temminck, *Pl. Col.* 594, fig. 1, apud G. R. Gray. Length six inches and upwards, of wing two inches and five-eighths, and tail two inches and a half, the latter broad and much graduated, its outermost feathers being an inch shorter than the middle ones: bill to forehead above five-eighths of an inch, and to gape nearly seven-eighths of an inch : tarse seven-eighths of an inch. The extraordinary character of this species consists in the curious form of the feathers of its flanks and rump, which on the latter, in fine specimens, are two inches and a half in length, being very numerous and dense, and consisting of long and flexible flattened stems, conspicuously white, and scantily fringed with fine discomposed and lengthened hair-like barbs, of a dark colour. The crown is bright rufo-ferruginous ; throat black ; back and breast deep tawny olive-brown, darker on the wings, and more dusky towards the flanks ; and the tail is uniform dusky-black : bill black, and legs dusky probably tinged with lead-colour. This bird is barely separable from *Timalia*, but has the bill less laterally compressed.

Trichastoma, Nobis; n. g. Also nearly allied to *Timalia*, but having a moderately stout Warbler's bill, and very long slender setæ at the gape, affording a ready distinguishing character.

* *Tr. rostratum*, Nobis. Length above six inches, of wing two inches and three-quarters, and tail two inches, its outermost feathers three-eighths of an inch shorter than the middle ones; bill to forehead (through the feathers) above three-quarters of an inch, and fifteen-sixteenths of an inch to gape; tarse fifteen-sixteenths of an inch; middle toe and claw seven-eighths of an inch, and hind toe and claw nearly three-quarters of an inch. Colour of the upper parts uniform olive-brown, somewhat darker on the crown, and having a slight ruddy tinge on the rump and tail; whole under-parts pure white, a little sullied on the breast and lower tail-coverts; lores and sides of the head pale fulvescent-brown, and sides of the neck to the breast ashy: upper mandible horny-black, the lower yellowish-white except at its extreme tip ; and legs deeply tinged with yellowish-brown.

* *Tr. affine*, Nobis. So like the other in plumage as to cause some doubt, on a first view, whether it be specifically distinct; but the much smaller size, and different

* The same indefatigable naturalist has described *T. Nipalensis* and *T. pcltlotis*, H., *As. Res.* XIX, 182; neither of which I have seen. There is also a Javanese *T. thoracica*, v. *Pitta thoracica*, Temminck, *Pl. Col.* t. 76, which is referred to the present genus in Griffith's 'Animal Kingdom," VI, 402, being described as "olivaceous brown above; underneath testaceous-grey; narrow white band from base of bill passes over the eye." Several species from the Indian peninsula have also been described by Messrs. Franklin, Sykes, and Jerdon; but the greater number of these constitute the distinct group *Malacocercus*, Swainson. The following must, however, be excepted.—*T. hyperythra*, Franklin, *P. Z. S.* 1831, p. 118, described as follows: — "*T. suprà olivascenti-brunnea ; capite in fronte corporeque toto subtùs rufis ; caudâ supernè fusco obsolete fasciatâ ; rostro paltido. Longitudo* 5." The specimen sent to the Society by Mr. Jerdon for this species is rather larger, and has the throat and upper-part of the fore-neck conspicuously white; the frontal plumes merely rufescent-brown, and very rigid, as are in a less degree those of the crown, which it is evident are usually raised, while those of the forehead would at all times stand up forming a sort of crest, somewhat as in *Pastor cristatellus*. Though referrible in preference to *Timalia*, this species is little else than a miniature of the *Malacocerci*.—*T. hypoleuca*, Franklin, *loc. cit.*

colour, of the legs and feet, and also the much shorter bill, have decided me to adopt the present course with it. Length five inches and three-quarters, of wing two inches and five-eighths, and tail two inches and a half, its outermost feather nearly five-eighths of an inch shorter than the middle ones; bill to forehead (through the feathers,) not five-eighths of an inch, and nearly thirteen-sixteenths of an inch to gape; tarse three-quarters of an inch; middle toe and claw under eleven-sixteenths of an inch, and hind toe and claw rather more than half an inch. General colour rather paler than in the preceding, excepting on the head; the nape much paler; and rump inclining to fulvous more than rufous: tail and its coverts brighter rufous than in the other; and breast crossed with pale fuscous. Bill wholly pale, and legs appear to have been green.*

**Goldana* (G. R. Gray) *nigrocapitata; Brachypteryx*† *nigrocapitata*, Eyton, *P. Z. S.* 1839, p. 103,—distinct from *Br. atriceps* of Jerdon. Length six inches and a quarter to six and a half, of wing two inches and five-eighths, and tail the same, its outermost feather five-eighths of an inch shorter than the middle ones; bill to forehead (through the feathers) eleven-sixteenths of an inch, and to gape seven-eighths of an inch; tarse an inch and one-eighth. General hue of the upper parts rufous-brown, of the under bright ferruginous: throat white, flanked by a black streak: cap black, bordered by a white superciliary streak and loral feathers; ear-coverts dusky, minutely lineated with white and posteriorly with rufous: sides of the head ashy; bill horny-black above, the lower mandible yellowish-white; and legs brown.

**Oriolus castanopterus*, Nobis. A typical Oriole of small dimensions. Specimen apparently female, or perhaps young male. Length about eight inches, of wing four inches and a quarter, and tail two inches and one-eighth; bill to forehead seven-eighths of an inch, and to gape an inch; tarse three-quarters of an inch. Plumage ge-

identical with *T. Horsfieldi*, Jardine and Selby, *Ill. Orn.* pl. CXIX: vide *J. A. S.* XI, p. 199. Rather a peculiar species, with not a little of the form and aspect of *Calamophilus*. — *T. platyura*, Jerdon, *Supplement.* "Plumage above dark olive-brown, beneath ochry-yellowish; bill yellow-horny; legs fleshy-yellow; irides yellowish-brown: tail-feathers obsoletely barred, very broad; 1st and 2nd quills graduated, 4th longest, 3rd and 5th equal. Length five inches and a quarter; wing two inches and a half; tail two inches and a half; tarsus nine-tenths; bill at front four-tenths; at gape six-tenths: bill much compressed; plumage very lax. I was at first," continues Mr. Jerdon, "inclined to take this little bird for a *Warbler*, but a review of all its characters has induced me for the present to place it among the *Timaliæ*. I procured a specimen in long reedy grass at Goodaloor at the foot of the Neilghierries. It took short flights and endeavoured to conceal itself among the thick reeds. Its food consisted of insects." Possibly a member of my new genus *Trichastoma* described in the text, as is decidedly Mr. Jerdon's *Timalia poiocephala*, which he has sent me. (Vide *Addendum* introduced at the close of *Appendix*, No. 2, of the present Report.)

* A third species of this group exists in the *Timalia poiocephala* of Mr. Jerdon's *Supplement*, which has a good deal the aspect of a *Curruca*, and likewise considerably resembles the *Hemiparus* (olim *Siva*) *Nipalensis*, Hodgson, *Ind. Rev.*, 1838, p. 89, but is readily distinguished from it by the rufescent hue of its under-parts, the length of the rictorial vibrissæ, and absence of any dark line over and beyond the eye. Length six inches, or nearly so; of wing two inches and five-eighths, and tail two inches and a half; bill to forehead (through the feathers) above half an inch, and three-quarters of an inch to gape; tarse seven-eighths of an inch. Head and neck dull cinereous, the body greenish olive-brown, inclining to tawney on the rump, wings, and tail; beneath light rufescent-brown, the rufous tinge increasing on the belly, and lower tail-coverts dull tawney. Bill dusky above, yellowish at the edges and tip; "legs pale fleshy; and irides white. I procured a single specimen of this bird," writes Mr. Jerdon, "on the Coonoor Ghaut, in high forest jungle. It was alone, flying from branch to branch, and had been feeding on small insects." The *vibrissæ* in this species are less lengthened and thicker than in the others.

† Previously employed in other classes.—G. R. Gray.

nerally similar to that of *O. Galbula*, but the shade of colour darker, especially on the head; beneath throughout yellowish white to the lower tail-coverts which are bright yellow, and lineated with black from the breast; greater wing-coverts conspicuously margined externally with ferruginous, and tertiaries edged with the same towards their tips; primaries slightly edged with whitish; and all the tail-feathers, save the middle pair or uropygials, largely tipped on their inner web with bright yellow, contrasting with deep black: bill pale, and feet greenish lead-colour.*

Anthus Malayensis, Eyton, *P. Z. S.* 1839, 104. This species, which we also possess from Tenasserim, is, I have little doubt, that insufficiently described by the author cited, who should at least have given the length of the wings to help in identifying a member of this difficult genus. It is, he remarks, the *A. pratensis* of Raffles, being nearly allied [in plumage,] to *A. trivialis*, but differing in its larger size. It is also common about Calcutta, and occurs in Southern India upon the Neilghierries, where alone it has fallen under the observation of Mr. Jerdon.

**Coturnix Phillipensis*, Brisson; *Tetrao Chinensis* and *Manillensis*, Gmelin; *C. excalfaloria*, Temminck: male and female.

Ortygis atrogularis.

**Crex fasciatus; Rallus fasciatus*, Raffles, *Lin. Trans.* XIII, pt. II. 328. Nearly allied, it would seem, to *R. fuscus*, Lin. Length eight inches, of wing four and a half to five inches, and tail an inch and a half; bill to forehead seven-eighths of an inch, and tarse an inch and five-eighths; middle toe and claw an inch and seven-eighths. Upper-parts deep rufous-brown, the head, neck, and breast, bright dark ferruginous, paler on the throat; belly, flanks, and under tail-coverts broadly banded white and black, the latter broader in old birds, the former in younger specimens; wings dusky-black banded with white or fulvous-white. "Bill bluish-black, feet red, irides red." (Raffles.) Younger specimens, or perhaps females,

* I have obtained the true *O. Galbula* in this neighbourhood, and the other Indian and Malayan species known to me are as follow:—

O. aureus, Gmelin; to which Mr. Jerdon refers the *O. Galbula* of Sykes's catalogue (*P. Z. S.* 1832, p. 87), and also *O. kundoo*, Sykes, as the young bird. It closely resembles *O. Galbula*, but has shorter wings, and the black facial streak passes beyond the eye: from the nearly allied African *O. auratus* it differs in the greatly diminished quantity of yellow upon its wings. Though very common in peninsular India, I have not yet met with it in this neighbourhood.

O. Chinensis, Gmelin; *O. hippocrepis*, Wagler; *O. acrorhynchus*, Vigors, *P. Z. S.* 1831, p. 97; *O. Maderaspatanus*, Franklin, *P. Z. S.* 1831, 118, apud Jerdon, as (doubtfully) the young. BLACK-NAPED ORIOLE. Not common in India, but much more frequent in the countries to the eastward.

C. Hodsonii (Hodgsonii?), apud Swainson, v. *O. melanocephalus* of India, as distinct from that of Africa styled *Capensis* by Swainson, who has described a second black-headed African species as *O. brachyrhynchus*, while a fourth presenting the same character inhabits the Malay countries, and the *O. Traillii* constitutes a fifth. Very common in Bengal, and hardly less so, it would appear, throughout India from the Himalaya southward; extends eastward to China, but is not included in Dr. Horsfield's catalogue of Javanese birds, whereas *O. Chinensis* is there enumerated. *O. McCoshii*, Tickell, *J. A. S.* II, 577, is the once-moulted male.

O. leucogaster, Reinwardt; *O. xanthonotus*, Horsfield, *Lin. Trans.* XIII, pt. I, p. 152, and figured and further described in the 'Zoological Researches in Java.' Malay countries generally.

O. Traillii, Hodgson; *Pastor Traillii*, Vigors and Gould; *Psarophilus Traillii*, Jardine and Selby. Himalaya, and likewise Ava. In all seven oriental species, of which the two peculiar (so far as I am aware) to the Malay countries, — viz. *O. leucogaster* and *O. castanopterus*, — are remarkable for their small size.

have the colours less intense. The immature plumage has no rufous on the head, neck and breast, which are dull grey-brown, and the bars on the under-parts are much less defined; throat whitish.

In the suite of the foregoing Malayan species, I now proceed to describe a magnificent *Podargus*, which appears to be the *Bombycistoma Fullertonii* of Capt. Hay *(J. A. S.* X, 573*)*, though not minutely agreeing in all respects with the description furnished by that gentleman. It is the species mentioned in one of my reports, *ante*, p. 106, and there is reason to suspect that the specimen was obtained in the Malay peninsula.

Podargus Fullertonii (?). Length about sixteen inches, of wing ten inches and a quarter, and tail eight inches, its two outermost feathers successively much shorter; bill to gape two inches and a half, and the same broad at base, its vertical height at base about five-eighths of an inch; tarse seven-eighths of an inch. Colour different shades of fine rich rufous-brown, with a banded whitish half-collar at the nape, and very remarkable elongated white spatulate tips to the wing-coverts, laterally margined with black, each being prolonged beyond the dark portion of the feather, and curling upward so as to rise from the even surface of the wing, with the fine dark ferruginous-brown of which they contrast strongly: quills and tail less deep ferruginous-brown, banded with a still paler tint, which is slightly bordered with blackish; scapularies and tertiaries having each a terminal black spot; interscapularies dark, and but indistinctly mottled: crown brown, with little or no rufous tinge, and a subterminal irregular whitish streak, bordered with black, to each plume: feathers of the nuchal collar lengthened and fulvous-brown, rayed with dusky-black, and having a subterminal broad fulvous-white transverse band, which is also edged with black both above and below: under-parts comparatively dull ferruginous brown, with small whitish spots on the breast, and faint mottling; the belly paler; and lower tail-coverts whitish banded with light brown; ear-coverts rufous-tinged, and a pale streak over the eye becoming more conspicuous beyond it. Bill and feet brown, the former whitish towards the gape.

Capt. Hay's second species is probably the *Podargus stellatus*, Gould, *P. Z. S.* 1837, p. 43, being received from Malacca, whereas Mr. Gould's specimen was obtained from Java. His third species appears to be an *Eurylaimus* with which I am unacquainted.

The *Podargus Javanicus*, Horsfield, already noticed by Mr. Eyton as inhabiting the Malay Peninsula, likewise occurs, as I have been informed by Mr. Jerdon, in Southern India, that gentleman having received "a very accurate description" of the species, drawn up from a specimen killed in Coorg. It is rather an unexpected addition to the Ornithology of India.

The more interesting species which I have lately procured in this neighbourhood are as follow:—

Cuculus micropterus.

C. niger, Latham, v. *C. Bengalensis niger*, Brisson; of which the middle-aged female is *C. tenuirostris* of Hardwicke and Gray, and the adult male is the doubtfully cited *C. flavus* of Mr. Jerdon's list: a mature male.

Cypselus affinis, Gray: very abundant at all seasons. C. *palmarum* is less so, and no other species are met with in this vicinity. Of Swallows *(Hirundo)*, I have never

yet seen a single individual in Bengal, but the Society possesses an example of *H. rustica*, which was shot at no great distance from Calcutta.

Mirafra Assamica: nestling plumage, which helps to affine this genus to the Larks.

**Dicœum erythronotum*: male and female.

Tephrodornis superciliosus, Swainson, v. *Lanius Keroula*, Hardwicke and Gray. The female of this bird appears to present an extraordinary difference from the male. I brought down two at a shot, from a small party on the higher branches of a tall tree, where they were making much the same kind of noise as a family of young Shrikes. One was a young male, retaining most of its nestling feathers, which on the head and body resembled the corresponding garb of *Muscicapa grisola*, while the wing-coverts, tertiaries, and tail, were those of *Lanius;* and this specimen, like the adult male, has the two outermost tail-feathers almost wholly white; the other bird was an adult female, with no white whatever on the tail, which is besides shorter and less rounded; and the superciliary streak and dark colour of the ear-coverts are also wanting: in other respects the two resemble; but the diversity in the tail is so remarkable, that I imagine few would incline to regard them as specifically the same.*

Columba Javanica: interesting as proving the existence of this beautiful species in the neighbourhood, where indeed (in the Botanic Garden,) it is not uncommon.

Numenius arquata.

Tringa subarquata: fine summer plumage.

**Gallinula lugubris;* Horsfield, *Lin. Trans.* XIII, pt. I, p. 195: male.

**Rallus rufescens*, Jerdon, *Madr. Jl.* No. XXIX, 205: female.

A considerable number of skins have likewise been set up.

I am, Sir,

Your's obediently,

Edward Blyth.

Appendix to Report, No. I. —— The Asiatic Drongos (*Edolius*, Cuv.). Upon a former occasion *(ante*, p. 169 *et seq.)*, I was partially successful in my endeavour to elucidate the various Oriental species of this group, which I am now enabled to monograph, I think, satisfactorily: and to aid the student in determining the various species with which I am acquainted, I annex a plate with figures of the beak of each of them, and proceed to offer a conspectus of the series with their synonymes.

Subgenus *Criniger*, Tickell, 1833; *Cometes* (olim *Chibia*), Hodgson, 1837.

1. *Edolius Crishna* (Latham), Gould; —— *splendens*, Tickell; —— *casia*, Hodgson: ante, p. 171. Figs. 1 and 2.

Subgenus *Edolius* (Cuvier), Nobis; *Cometes* (in part), Hodgson.

2. *E. grandis*, Gould; —— *malabaricus*, Shaw and Stephens; —— *malabaroides*, Hodgson: *ante*, p. 170. Figs. 5 and 6.

3. *E. retifer*, Temminck; —— *platurus*, Vieillot; —— *malabaricus* Gould; —— *cristatellus*, Nobis; —— *grandis*, apud Horsfield†: ante, p. 170. Fig. 7.

* I have since shot a female of this species not differing from the male, which leads me to conclude that the female above noticed is distinct.

† Identified as such by Dr. McClelland's drawing of the specimen; and accordingly Dr. Horsfield's remark is explained, that the Assamese specimens of supposed *grandis* "agree with the specific character and description given by Mr. Gould in all points excepting the size, being about one third smaller." The present is also Mr. Jerdon's species.

4. *E. Rangoonensis*, Gould;—probably the *Malabar Shrike* or *Drongo* of Buffon and Sonnerat:* *ante*, p. 172. Figs. 8 and 9.

N. B.—— Either the first or second of these three species (probably the first of them) is the *Cuculus Paradiseus*, Lin., the *Coucou vert huppé de Siam* of Brisson, or *Coucou à longs brins* of Buffon, as founded on a drawing by a M. Poivre, who had figured the feet to be zygodactyle: the same artist had in like manner misrepresented the *Pica (Cyanocorax) erythrorhynchos*, which accordingly has been described as the *Coucou bleu de la Chine, en langue Chinoise, San-hia*, of Brisson and Buffon, and the *Cuculus Sinensis*, Linnæus. This species was observed in Chusan by Dr. Cantor.

Subgenus *Melisseus* (olim *Bhringa)*, Hodgson.

5. *E. remifer*, Temminck; —— *tectirostris*, Hodgson; —— *Rangoonensis (?)*, apud Horsfield: *ante*, p. 169. Figs. 3 and 4.

Subgenus *Prepopterus* (olim *Chaptia)*, Hodgson.

6. *E. æneus*, Vieillot; —— *muscipetoides*, Hodgson. Figs. 20 and 21. *Butchanga* of the Bengalees.

Subgenus *Dicrurus* (Vieillot), G. R. Gray, olim *Buchanga*, Hodgson.

7. *E. viridescens (?)*, Gould: ante, p. 173. Figs. 10 and 11.

8. *E. balicassius* (Linnæus);—*affinis*, Nobis (*ante*);—Javanese *forficatus (?)*, Horsfield: *ante*, p. 174. Figs. 12 and 13. A fine adult, recently obtained from Singapore, has the wing five inches and three-quarters long, middle tail-feathers four inches and three-eighths, and the outermost above seven-eighths of an inch additional; the tip of the latter curling nearly as much as in *E. Fingah*, from which species this differs in its shorter and much less deeply forked tail, and in the superior size and much greater vertical height of the bill, the upper ridge of which is also considerably more angulated.† In both the abdominal feathers of the once moulted birds are tipped with greyish-white, which totally disappears in the plumage of full maturity. I doubt whether that now under consideration occurs in India, but it seems to be the common species of the Malay countries generally, including the Phillipine Islands (from whence it was originally described by Brisson and Buffon), and it is said to extend even to Australia (apud Vigors, *Lin. Trans.* XV, 211).

9. *E. Fingah*, Shaw (the young),—*Indicus*, Stephens (the adult);—*albirictus*, Hodgson;—*balicassius*, Nobis *(ante)*, as also of Jerdon and other writers on the Ornithology of peninsular India. Figs. 14 and 15. Shaw appears to have had no further authority for this species than Edwards's figure of the "Fork-tailed Indian Butcher-bird," which he erroneously refers to *Lanius cœrulescens* of Linnæus; and holding this opinion, he had no right to clog our systems with a superfluous name: quoting, too, the Linnæan definition of *cœrulescens*, and perhaps following Edwards's description, or, it may be, describing from that author's plate, it would seem that the most has been made of the whitish tips to the abdominal feathers of the young of our present species, thus bearing out the mal-identification with *cœrulescens*.

* "Il manque de huppe."—Buffon.

† This bird is the *Corvus balicassius* of Linnæus, and in truth its beak partakes much of the corvine form, so that the species might be styled with propriety the *Crow-billed Drongo*, as the next might be equally well named the *Shrike-billed Drongo*.

His statements, however, that "this species is described and figured by Edwards, from a specimen brought from Bengal, where it is known by the name of *Fingah*," and that "it is said to be a great persecutor of the Crows, which it attacks and obliges to quit its haunts," leave no doubt in my mind that the present is the species intended, inasmuch as though others of this genus likewise drive away the Crows, still this is the common *Fingah* of the Bengalees, familiarly known to every body, and its beating off the Crows and even Kites is here a scene of daily observation. A seemingly constant character of this species is a minute white spot at the rictus, which does not occur in any of the other species, and hence the appropriate name of *albirictus* bestowed by Mr. Hodgson.

10. *E. macrocercus*, Vieillot;—*annectans*, Hodgson, — *Muscicapa biloba*, Lichtenstein, apud Griffith's work;—*Neel Fingah* of the Bengalees: *ante*, p. 173. Figs. 16 and 17.

11. *E. cœrulescens* (Linnæus). Figs. 18 and 19.

12. *E. cineraceus*, Horsfield, *Lin. Trans.* XIII, pt. 1, p. 145;—probably also *D. leucophæus*, Vieillot, *Dict. Class d'Hist. Nat.* V, 621, which, with *D. Ceylonensis*, Stephens, are referred to (and the latter founded on) the *Drongri* of Levaillant. "*E. cineraceus saturatus concolor, remigibus supra ad apicem rectricibusque lateralibus margine exteriore, nigris. Longitudo* 11 *poll.*" Horsfield: who adds that—"Although very similar to *forficatus* [which I suspect to be *balicassius verus*], it must be considered a distinct species; the bill is more robust, and the exterior tail-feathers form a greater curve; it is much less common, and the natives of Java distinguish it by a peculiar name." *Dicrurus leucophæus*, Vieillot, is briefly described as having "*tout le plumage d'un gris plombé avec l'extremité des remiges d'un brun noirâtre; barbes exterieures des rectrices noires; queue longue et fourchue; bec et pieds plombés. Taille, neuf pouces. De Ceylon et de Java.*"

13. *E. leucogaster* (Vieillot), *Dict. Class. d'Hist. Nat.* V, 622 (1824); *D. albiventris*, Stephens, (1825): founded on Levaillant's *Drongo gris à ventre blanc*, and suspected by both Vieillot and Stephens to be merely a variety of the last, or *leucophæus*, Vieillot. "It chiefly differs in having all the under-parts, *from chin to vent*, white," and therefore cannot be identified with *cœrulescens*, to which Mr. Jerdon has assigned *leucogaster* as a synonym.

14. The only remaining species which I can find ascribed to this part of the world is *D. æratus*, Stephens. "Inhabits Bengal. Beak and legs black: general colour of the plumage above black, with a brilliant changeable blue gloss, like bronze, in some lights appearing green: belly, sides, and under tail-coverts, dull black-grey; under-parts of the wings and tail black; the last forked: the hairs about the nostrils point forward [as a matter of course], and there is a large oval patch of black beneath the eye." Is much in need of verification.

Explanation of Plate.

Figs.	1 and 2	*Edolius krishna.*	
,,	3 and 4	,,	*remifer.*
,,	5 and 6	,,	*grandis.*
,,	7	,,	*retifer.*
,,	8 and 9	,,	*Rangoonensis.*
,,	10 and 11	,,	*viridescens?*

Figs. 12 and 13 *Edolius balicassius.*
,, 14 and 15 ,, *Fingah.*
,, 16 and 17 ,, *macrocercus.*
,, 18 and 19 ,, *cœrulescens.*
,, 20 and 21 ,, *æneus.*

Appendix, No. 2.—Genus *Turnix*, Bonn. (1790); *Tridactylus*, Lacepede; *Ortygis*, Illiger; *Hemipodius*, Temminck: the *Three-toed Quails* of sportsmen. On a former occasion (Vol. XI, p. 586), I referred a pair of specimens, male and female, of this genus, to the Malayan *T. atrogularis*, Eyton, *P. Z. S.* 1839, p. 107; to which also I now find that I should have assigned the Malayan female noticed at p. 204, and there wrongly identified with *T. taigoor* of Sykes, which latter is, however, included by Mr. Eyton in his list of a collection of Malayan birds, wherein he has characterized the *T. atrogularis:* but the similitude of some females of these species is so extremely close, that it is almost (if not quite) impossible to discriminate them, even though ordinarily they are distinguishable at a glance; and now that the Singapore collection noticed in the foregoing report has yielded undoubted examples of both sexes of *T. atrogularis*, it appears to me that of the pair first mentioned, the male pertains decidedly to that species, while the female sent with it should perhaps be referred to *T. taigoor*. I have now four continental eastern species before me, of which the males of three would appear to be normally distinguished from the other sex by having the throat and middle of the fore-neck and breast jetty-black; but in *T. atrogularis* this black is very much broader than in *T. pugnax* and *T. taigoor*. Col. Sykes states, indeed, that the last mentioned species is devoid of this colour, which is the case with one specimen marked male in the Society's Museum, but another example before me has fully as much of it as *T. pugnax:* again, of the latter species, remarks Mr. Jerdon, "Col. Sykes and M. Temminck assert the identity of the plumage of both sexes [each having the mark], and though I did not examine them when I shot several in company, they were always clothed alike"; on the other hand, M. Drapiez states *(Dict. Class. d'Hist. Nat.*, Art. *Turnix)*,—"La femelle [of *T. Pugnax*] a généralement les couleurs du plumage beaucoup moins vives; la bande longitudinale de la gorge au lieu d'être noire est blanche avec un simple trait noir qui l'encadre; le milieu du ventre est d'un blanc roussatre." Of the *T. Luzoniensis*, v. *H. thoracicus*, Tem., of the Malayan Archipelago, Sir Stamford Raffles observes, that "the throat is black in the males, generally whitish in the females"; and I imagine that the fully adult males of all these exhibit the black mark, while (in various degrees, according to the species,) the young males, and a greater or less number of old in addition to the young females, are devoid of it, some also presenting a mere trace of this marking, as stated by M. Drapiez of the female of his *pugnax:* and it should be borne in mind that this is a genus of which several species are so closely allied together, and withal so numerous in species, that in cases of conflicting testimony there is generally much room for doubt whether precisely the same species be intended by different writers.

I proceed to offer descriptions of all the oriental species which I know of.

1. *T. pugnax*, apud Sykes and Jerdon; perhaps *Tetrao nigricollis* and *Madagascariensis* of the older authors, though it is unlikely that the very same species inhabits Madagascar. Length six inches and a half; of wing three inches and a half; bill to forehead (through the feathers) nearly five-eighths of an inch, and fully a quarter of


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an inch in vertical depth; tarse an inch, and middle toe and claw seven-eighths of an inch. Upper-parts rufous, with transverse black lines on each feather of the back, scapularies, and rump, these having also yellowish-white lateral margins, internally edged with black; sides of the lower part of the neck and breast, together with the more conspicuous feathers of the wings, fulvous-white, with tolerably broad black cross-bars; below the breast light and bright ferruginous; throat and middle of the fore-neck, to the commencement of the breast, deep black; and crown rufous, with a series of black and white feathers, appearing as white spots set off with black, along the mesial line, another and broader series over each eye, a third bordering the black throat, and the sides of the upper-part of the neck covered with the same, appearing as whitish with black edgings to the feathers; quills brownish-dusky, with pale edges. The description of the female by M. Drapiez has already been cited, whilst M. Temminck and Col. Sykes assert that it does not differ from the male. The example here described is from Madras, and the species is understood to inhabit the Indian peninsula where it is tolerably common, Java, and (very doubtfully) Madagascar.

2. *T. taigoor*, Sykes: 'Bengal Sporting Magazine,' Oct. 1836, pl. I, fig. 6; *H. plumbipes*, Hodgson, Ibid. May, 1837, p. 346; 'Bombay Literary Transactions,' II, 271. The species which I conclude to be this, presents scarcely any difference in plumage from the preceding: the upper-parts are merely browner and less rufous, especially the head and nape, and the black cross-bars of the dorsal feathers are commonly broader and incline to be confluent, the markings generally being somewhat less clearly defined; but the size is inferior, and the beak proportionally more slender. Length five inches and three-quarters; of wing three inches and one-eighth, or less; bill to forehead (through the feathers) nine-sixteenths of an inch, and under three-sixteenths in vertical depth; tarse not seven-eighths of an inch, and middle toe and claw three-quarters of an inch. The male specimen before noticed as wanting the black gular streak has also the light ferruginous colour below the throat paler and less developed, the throat being spotless whitish, flanked with dusky specks. This appears to be the species figured in the 'Bombay Literary Transactions,' as above cited, which is stated to be common in Guzerat and in Malwa. "Extent of wings nine inches and a half." In the peninsula, Mr. Jerdon has "only procured it solitary, in long grass in the more open spaces of the Western coast." It is not uncommon in the vicinity of Calcutta, where I have found it breeding, in the Botanic Garden. As occasional females of this and of the next so much resemble, and Mr. Eyton, while enumerating *T. taigoor* in his list of species from the Malay peninsula, describes only the male of his *T. atrogularis*, it is certainly not improbable that he mistook the female of that bird for the present species.

3. *T. atrogularis; H. atrogularis*, Eyton, *P. Z. S.* 1839, p. 107. Intermediate in size to the two preceding species, with as stout a bill as the first (in old males), and seldom much trace of rufous on the upper-parts, the predominant hue of which is a sort of dusky-chocolate, having much black intermixed, the transverse lines mostly confluent and suffusing a considerable portion of the feather; the black bars on the sides of the breast and wings, also, are broad, so as to assume an oval or even round form, and the fulvescent tinge on the belly is not very deep, and mostly extends up the breast; the black of the breast and fore-neck of the male is, as

already noticed, very much broader than in the others, whence this sex may always be readily distinguished, which is not the case with the females in every instance, even by referring to the thickness of the bill, which presents a much less marked distinctive character than in the male. Length about six inches, of wing three inches and three-eighths, or generally under three inches and a quarter in the female; bill to forehead (through the feathers) five-eighths; and tarse an inch, middle toe and claw seven-eighths of an inch. It is evidently very common in the neighbourhood of Singapore, and occurs in the Tenasserim provinces.

4. *T. Dussumieri*, 'Bengal Sporting Magazine,' October, 1836, pl. I, fig. 5; *Hemipodius variabilis*, Hodgson, Ibid. May 1837, p. 345; *Button Quail* of sportsmen. This is the most abundant species of India generally, including Bengal, and it extends northward into Nepâl, where it is also numerous; but I have not yet seen it from the eastern side of the Bay. Its length is five inches and a half, with wing two inches and three-quarters; bill slender, and half an inch to forehead through the feathers; tarse three-quarters of an inch, and middle toe and claw five-eighths of an inch. Throat whitish in both sexes, flanked with a few transverse dusky specks; and middle of the breast of the same fulvescent hue as the belly of the others, more or less deep: the colour of the upper-parts most nearly resembles that of *T. pugnax*, but the black is rather more predominant, especially on the rump which is chiefly of this hue; the belly is whitish; and the wings marked differently from those of the three preceding species, having a whitish ground-tint, upon which each feather shews a large rufous spot, containing a smaller black one externally; and these spots being longitudinal instead of transverse.

The following oriental species have also been described, and it will aid the student to give detailed notices of them.

5. *T. nigrifrons; H. nigrifrons*, Tem. "Six inches in length, having the forehead ornamented with three broad bands; the first of which is formed of small white feathers, arising from the base of the beak to the nostrils; the second, which is twice as broad as the first, is deep black; and the third, which extends beyond the eyes, pure white: the top of the head is of a fine red, with delicate black stripes in the middle of the feathers; the nape is slightly tinged with bright olive; the back, rump, and upper tail-coverts are of a reddish-yellow, tinged with black and fawn-colour; the lesser and middle wing-coverts are yellowish, each feather having a small black spot towards its tip; the secondaries and greater quills are grey; the throat bright reddish-yellow; neck and breast the same, having all the feathers sprinkled with semicircular black spots; belly and thighs pure white: bill red; and feet reddish, the claws black. Said to be a native of India, and described by Temminck from a single specimen in the Paris Museum." Stephens, in Shaw's Zoology.

6. *T. maculosus; H. maculosus*, Tem. This is an Australian species, but is stated in Griffith's work also to inhabit India, upon the authority of Gen. Hardwicke; and I make no doubt that the Indian bird here referred to is the same as that figured, together with another little known species, as two different *Bustard Quails* of sportsmen (both of them differing also from the preceding species of this genus), in the 'Bengal Sporting Magazine' for March, 1838, the present being represented as fig. 2 of the plate. The following is Stephens's description of the *O. maculosus* of Australia, in the Appendix to Shaw's 'Zoology.' "Distinguished by its very short

tail, which scarcely exceeds the tips of the wings when closed; its length is five inches: the top of the head is varied with black spots, and the whole of the feathers are tipped with greyish-red; a white hand extends over the crown; the eyebrows, sides of the neck, and nape, are bright red; the throat and cheeks reddish-white; the fore-part of the neck, breast, belly, sides, and thighs, are red, and (with the exception of the feathers of the sides and those of the edge of the breast, which are varied with stripes of black and reddish-white,) they are spotless; the feathers of the top of the back and the scapularies are black in the centre, bordered with white, and tipped with red; those of the middle of the back and the long ones which hide the tail, are deep black, varied with rufous undulations, and slightly edged with yellowish; the scapularies are a little spotted with grey-blue; the wing-coverts are reddish-yellow; the whole of the feathers with a black spot near the tip, and the longer ones with the inner webs red, spotted with black; primaries and secondaries bright grey, edged with reddish-white; the bill and feet fine yellow." Capt. Brown's figure of the Indian bird before referred to accords tolerably well, upon the whole, with this description, differing chiefly a little about the head.

7. The other *Bustard Quail* is identified by that gentleman with the *Dubkee Quail* of Latham, *Gen. Hist.* VIII, 340, and which is thus described by that author. "Length under five inches. Bill pale. Head mottled whitish and ash-colour; all round the neck and sides ferruginous; down the middle from the chin, paler ferruginous; the rest of the upper-parts fine pale ash-colour, varied with paler spots, inclining to rufous; under-parts cinereous clay-colour, marked on the sides of the breast with round black spots of several sizes; greater wing-coverts and second quills pale clay-colour, spotted with black, some of the spots kidney-shaped; greater quills and tail plain dusky; legs yellow, and three toes only. Inhabits India, where it is called *Dubkee.*" Sir J. Anstruther.

"*A.* Bill and legs yellow: plumage in general pale grey, crossed with fine black lines; lower part of the neck behind, inclining to rufous; breast the same; outer part of the wing and breast marked with small, distinct spots of black. Inhabits India and China, called *Looah,*" — a name commonly bestowed on the tiny Bush Partridge, classed as *Coturnix Argoondah* by Col. Sykes.

Capt. Brown's figure of this species represents the back as handsomely ornamented with round white spots, margined with black.

8. Dr. Latham also describes a *Balen Quail,* which is very probably the *taigoor,* notwithstanding certain discrepancies. "Size uncertain. Bill black. Top of the head, even with the eyes, marked brown; down the middle of the crown a pale clay-coloured streak, and another over each eye, almost to the back; the chin, sides under the eyes, and throat, white; sides of the neck and breast clay-colour; down the middle, from the throat to the breast, a broad black streak; the rest of the under-parts pale clay-colour, each feather marked down the middle with a long black streak, rounded at the bottom; back and wings pale mottled brown, as the head, marked with a series of pale yellow streaks down the middle and two others of the same on each side, besides some fine similar lines from the shaft of each feather; legs pale red, three toes only.

"Inhabits India, called *Balen.* Sir J. Anstruther."

"One supposed to be a female, is marked much the same about the head, but with-

out the black down the breast, or the transverse curved marks on the throat: sides of the body dirty-white, with fewer black spots."

"With the above, another of the first. The plumage much the same, but darker in colour, and the under parts flesh-colour instead of pale rufous, or clay-colour. This is called *Gassur*, and is probably a young bird; the specimen differs however, in having on one leg a rudiment of a hind-claw."

"*A.* Length five inches. Bill pale blue; above, the body is pale mottled ash-colour, with a series of yellowish streaks; also some large spots of blackish before, and marbled behind; the wings pale brownish rose-colour, chequered with white, and in the interstices a spot of black; greater quills dusky; along the middle of the crown a slender yellow streak; the rest of the crown marbled; sides of the head paler; round the eye nearly white; beneath the bird is wholly buff-colour; sides of the breast spotted with black; tail blotched with brown; legs flesh-colour, no hind-toe."

"Inhabits India. Gen. Hardwicke. Taken in Cawnpore in May."

9. *T. Luzoniensis; Tetrao Luzs.* Gmelin: *H. thoracicus*, Tem.; *Turnix maculatus*, Vieillot. Common in the Eastern Archipelago. "About seven inches in length: the top of the head, cheeks, and nape, covered with black and white spots, more numerous on the former; the feathers of the throat are white, tipped with black; the under-part of the neck and breast are fine bright red; the belly, sides, and thighs, bright yellowish; back, rump, and feathers covering the tail, grey-brown, marked with delicate zig-zag black lines; the greater and lesser wing-coverts whitish-yellow, varied with black spots, having a bright red transverse line above each of the latter; the greater feathers of the wing are grey-brown, and spotless." Stephens.

Sir Stamford Raffles remarks, that "The colours vary much in different specimens. The head, back, and wings are varied with black, brown, and fawn-colour, of which sometimes the one, sometimes the other, predominates. In full-grown birds the head is generally black, spotted with white, particularly at the sides, while the back is more of a red-brown, and the wings are black, banded with white. The breast also varies, being sometimes ferruginous, but at a later period becoming marked with transverse bars of black and white. The abdomen is always of a ferruginous colour. The throat is black in the males, generally whitish in the females. Bill rather long, yellowish, which is also the colour of the legs. Irides white.

"These Quails are frequently kept tame, and the females are trained to fight with each other by the natives. The superior courage of the females has given rise to a common Malay proverb, in which a hen-pecked husband is compared to a *Puyu*. This species is always seen in pairs, never in flocks like the *Pikau (Coturnix Phillipensis)*.

"I am at loss to discover," continues Sir Stamford Raffles, "what species of Quail is intended by the *Tetrao suscitator*, or Indian Quail of Bontius. The *Pikau* and *Puyu* are the two generally known throughout the Eastern Islands. The latter is the most frequently domesticated, and becomes as tame as the common fowl. It is the only one trained for fighting, and they will often combat with such fury as to kill each other. It is not however noisy, and in the wild state is only seen in pairs. The *Pikau*, on the contrary, has a loud clear note, is seen in flocks, will not become so tame as the other, and is not valued for fighting. It would seem as if the man-

ners of both were confounded in the account given of *T. suscitator. Lin. Trans.* XIII. pt. II, p. 324.

T. Luzoniensis is also the only species included in Dr. Horsfield's Catalogue of the Birds of Java; but it may be that the *H. pugnax* of Temminck is regarded by Sir Stamford Raffles merely as a particular state of plumage of his *Luzoniensis*, for M. Temminck informs us that *H. pugnax* inhabits Java, where it is greatly prized on account of its pugnacious disposition, the inhabitants amusing themselves by setting the males (?) to fight in the manner of game-cocks. [Col. Sykes, it may here be mentioned, takes upon himself to assert of his *H. pugnax* that "its pugnacious qualities are quite unknown in Dukhun, and even in Java."] I should not be surprised if *T. atrogularis* should prove to be identical with the Javanese *pugnax*, while it is quite distinct from a Madras specimen of Col. Sykes's Indian *pugnax*, this being the only one I have to compare with several specimens of Mr. Eyton's *atrogularis* received chiefly from Singapore. Of *T. Luzoniensis*, I have no specimen to refer to, but there is a rude figure of this bird in Sonnerat's *Voyage à la Nouvelle Guinée*, upon which its specific name was founded. *La petite Caille de l'Isle de Luzon* of this author, represents the female of *Coturnix Phillipensis*.

10. *T. fasciatus; H. fasciatus*, Tem. Inhabits the Phillipines. "Rather above five inches in length. The whole of the fore-part of the neck, the sides of the head and of the breast, transversely striped with black and white; belly spotless red; top of the head black; the region of the eyes striped alternately with white and black; nape bright red; back and rump brown, varied with black and red; wing-coverts transversely striped with black and white; the feathers nearest the body having their outer webs black, tipped with grey: the feet and beak are yellowish." Stephens.

11. *T. rufus*, Vieillot. "*O. corpore suprà cinereo, punctis nigris; jugulo nigro alboque vario; corpore subtùs, remigibus primariis, rectricibusque lateralibus fusco-rufis; rostro corneo, basi nigricante, pedibus rubescentibus.*" Inhabits China.

Various other species of this genus occur in Australia, the whole of Africa, even Spain, and probably other parts of Southern Europe, and doubtless Western Asia; but there is none in America. The Society's Museum contains two from the Cape colony, of which one appears to be the *Spotted-necked Quail* of Latham, and the other (a pretty, small, red-breasted species,) I cannot find described; but then I have not Dr. A. Smith's 'South African Zoology' to refer to. I have brought together all the notices I could find of eastern species, though I do not expect that so many will eventually be verified as distinct; but the data here collected will be useful in assisting the investigations of such as may now bestow attention on the group, and certainly may be presumed to intimate that the latter is richer in Indian species than has hitherto been currently supposed.

The other small *Gallinaceæ* classed with the preceding as *Quails* by Anglo-Indian sportsmen are as follow,—all having a fourth or hind toe.

True Quails (genus *Coturnix*), having the first quill longest, the tarsi having no trace of spurs, &c. Habits migratory.

I. *C. dactylisonans:* the Common Quail. An inhabitant of Europe, Asia, and Africa, to the Cape of Good Hope. It is very abundant in the Upper Provinces of India during the cool months, less so in the peninsula, and is the most frequent species of *Coturnix* in the vicinity of Calcutta. Is rarely known to breed in this country.

2. *C. textilis*, Tem.; *Perdix Coromandelica*, Latham: the *Rain Quail* of sportsmen. Distinguished from the last by its smaller size, the plainness of its primaries, and especially by the black breast of the male. Is very numerous in the cultivated parts of the Indian peninsula, where many breed; but great numbers arrive in the N. E. provinces of the Bengal Presidency early in the rains, and, after breeding, depart thence (save a few stragglers, which are observed at all seasons,) in September. It is not common about Calcutta; and in Nepâl its migrations resemble those of the common species.

3. *C. flavipes*, Nobis. A remarkably diminutive species, which I understand is not rare in Bengal during the cool season. I procured a fine male alive, which I kept some time, but it unluckily made its escape. Afterwards I obtained a female, in bad condition, both of them having been brought with Larks, &c., by the bazar shikarees, and this, when it died, was ruined as a specimen by the Ants. However, its dimensions were—Length five inches and a half, by nine inches and a half in extent, the wing two inches and seven-eighths, and tarse seven-eighths of an inch. Legs bright yellow. The plumage does not differ much from that of the common Quail, and the sexes are similarly distinguished. This bird has a remarkably soft, piping note.

4. *C. Phillipensis*, Brisson; *Tetrao Chinensis* and *Manillensis*, Gmelin; *Coturnix excalfatoria*, Temminck. "There is an accurate description of this species of Quail," writes Mr. Jerdon, "in Mr. Elliot's notes, taken from a single specimen shot by a gentleman near Belgaum, in the southern Mahratta country." The Society has also received Nepâlese specimens from Mr. Hodgson: and Mr. Frith assures me that he has found it tolerably common in different parts of Bengal, as near Islampore, where he resides. In the Malay countries generally, it appears to be very abundant. Some notice of its habits, as the *Pikau* of Raffles, has been already cited. It is remarkable for the great dissimilarity of the sexes, and the male is perhaps the most beautiful bird of its genus.

The three next are pigmy Partridges, and exhibit every character of the genus *Perdix*, both as to form and habits; insomuch that I cannot recognise the genus *Rubicola*, Hodgson, proposed for them in the 'Bengal Sporting Magazine' for May, 1837. Col. Sykes unaccountably ranges them in *Coturnix*, as if size alone were sufficient to refer them to that group.

5. *Perdix Argoondah: Coturnix Argoondah*, Sykes, *P. Z. S.* 1832, 153; *P. olivacea*, Buchanan Hamilton; *Java Partridge* of Latham: *Bush Quail* of sportsmen.* Generally diffused over all India, where there is any low cover.

6. *P. rubiginosa*, Valenciennes; *Coturnix Pentah*, Sykes, Ibid; *Forest Quail* of sportsmen. Southern India only.†

7. *P. erythrorhyncha; Coturnix erythrorhyncha*, Sykes: *Black Quail* of Neilghierry sportsmen. Elevated districts of Southern India only.

Addendum.—Since the first portion of this report has been made up at the press, the Society has received from Mr. Jerdon, with numerous other specimens, a skin of his *Timalia platyura* (vide p. 796, note to preceding page), and I consider this bird

* Also termed *Rock Quail* in the peninsula.

† Mr. Frith, however, has since informed me that he is tolerably positive of having once obtained this species in Bengal.

to belong strictly to the Indian form of *Dasyornis* (Jardine and Selby), being the fourth Indian species referrible to it with which I am now acquainted.—E. B.

Museum Economic Geology.

Read the following letter from the Deputy Secretary to the Government of India, of 8th June last:—

No. 575.

To H. Torrens, Esq.

Secretary to the Asiatic Society.

General Department.

Sir,—With reference to the Correspondence noted in the margin, I am directed to transmit for the information of the Asiatic Society, the annexed Extract Paragraph 104, from a despatch from the Honourable Court of Directors in the Public Department, No. 6 of 1842, dated 22nd March, and to request that when several specimens of the same Minerals are received in the Museum of the Asiatic Society, duplicates thereof may be forwarded to this Department, properly packed for transmission to the Honourable Court.

From Officiating Secretary Asiatic Society, dated 12th June 1840, with Enclosure. To ditto dated 17th June.

I have the honour to be, Sir,

Your most obedient servant,

Council Chamber,
The 8th June, 1842.

H. V. Bayley,
Depy. Secy. to the Govt. of India.

Extract from a Letter No. 6 of 1842, from the Honourable Court of the Directors in the Public Department, dated the 22nd March.

2 & 3. Dr. T. Thomson appointed Curator to the Museum of the Asiatic Society on the allowance authorized by the Court. The acknowledgment of the Society presented to the Court for their liberal patronage.

104. As several specimens of the same Minerals are likely to be frequently received in the Museum of the Asiatic Society, we should like to be furnished with duplicate specimens of which the locality has been ascertained.

(True Extract,)

H. V. Bayley,
Depy. Secy. to the Govt. of India.

Read the following Report of the Joint Curator for the month of June last:—

Report of the Curator, Museum Economic Geology, for the month of June.

Museum Economic Geology.—We have been principally employed in this month in searching for, and arranging from the Society's old collections, a suite of Indian Iron Ores; and I have the pleasure of exhibiting a commencement of 69 specimens, comprising 34 species and varieties, some of which are new, as Indian Ores of that metal, as far as I am aware. The crystallised Phosphate of Iron No. 39, from Bundlecund, and the earthy Phosphate No. 66, from Assam, are the most remarkable of these. The series from Bundlecund is valuable as relating to Capt. Franklin's excellent paper and map in the XVIIIth vol. of our Transactions. We have also made some progress in the arrangements of the Indian Copper Ores.

Geological and Mineralogical Museum.—We have to announce here a discovery of the very highest importance to Indian Geology, which is that of Captain Herbert's MSS. Geological Report, and moreover the certainty, from its title page, that it was accompanied by a Geological Map! and

six coloured Views. The following letter, addressed by our Secretary to Government, entreating its assistance in the search for this invaluable document, will sufficiently explain its importance, and it is therefore needless to dilate farther upon it here.

To G. A. Bushby, Esq.

Secretary, General Department.

Sir,—The Committee of Papers of the Asiatic Society of Bengal desire me respectfully to state for the information of Government, that after upwards of eighteen months of persevering search, five volumes of Notes and Field Books, relative to Captain Herbert's Geological and Mineralogical Survey of the Himalayas, have been recovered ; and to this they have now to add also, the discovery of the Manuscript of his detailed Geological Report.

2. And from the title page to this Manuscript they further learn, that it was accompanied by a Geological Map and six coloured Views, which appear to have heen sent in to Government with it.

3. The importance of the recovery of this great mass of Scientific Knowledge, which with the extensive collection in the Society's rooms are the fruit of this costly survey, they will not dilate upon; but they beg earnestly to hring to the notice of Government, the immense value, both scientific and strictly financial, of the Geological Map could it he also recovered ; and in confirmation of this opinion they may refer to the vast lahour and expense which for the last twenty or thirty years past, has been bestowed, both in Europe and in America, upon Geological Surveys and Maps of various countries: (and especially of England and Scotland,) under the full conviction of the immense political advantages which have heen, and are to he eventually derived from them.

4. They trust then, that under these convictions, and with the hope that this really national loss, (for such it would strictly he both to India and to England,) may he yet averted hy the recovery of this valuable document from amongst the archives of Government, they therefore respectfully request, that strict search may he ordered in the records of the General and Political Secretariats, the Surveyor General's Office and any others, for any kind of Geological Maps, Sketches or Survey hy the late Captain Herbert or other persons. The date of his Manuscript Report is 1826.

Museum, (Signed) H. Torrens,

1*st July*, 1842. *Secretary, Asiatic Society.*

I may however be permitted to add that, from the great talent, untiring industry, clear and patient detail of facts, and absence of all leaning to hypothesis which distinguished so greatly our lamented associate, Captain Herbert, we may fairly hope, that if the Map is recovered, the Society at no distant day may have the satisfaction of doing full credit to the liberality of Government in the outlay for this costly Survey, and ample justice to his memory.

Amongst the old papers of the Physical Committee, we have also discovered a valuable one by Dr. John Adam on the Geology of Bundlecund, and this has enabled me to recognise Catalogue No. V. of our Geological collections, as heing the series pertaining to this very paper, which is now in the press for the Journal. When I state that it extends from Mirzapoor to Juhhulpoor, giving thus an excellent Geological outline for that distance, its value will be easily understood.

I have again renewed every search for the Catalogue relative to Captain Pemberton's Geological Series from his Bootan Mission, to which we have no clue, hut a very complete set of numbers on the specimens. Some hints from his Assistant, Captain Blake, lead me to hope, that the references, as in the case of Captain Herbert's collection, may he dispersed throughout his Note and Field Books, and I have written to Major General Macleod on the subject. We have no contrihutions to announce for this month.

H. Piddington,

Cur. Mus. Econ. Geol.

Museum, 30*th June*, 1842.